NATURAL HISTORY OF CENTRAL ASIA
VOLUME XI

THE MAMMALS OF CHINA AND MONGOLIA

PART I

美國博物館
中亞調查記

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THE MAMMALS OF CHINA AND MONGOLIA

BY

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With 22 Distribution Maps and 1 other Illustration in the Text
and with 9 Plates

NATURAL HISTORY OF CENTRAL ASIA

VOL. XI, PART 1

WALTER GRANGER, D.Sc., *Editor*

THE AMERICAN MUSEUM OF NATURAL HISTORY

F. TRUBEE DAVISON, *President*

NEW YORK

1938

THE MAMMALS OF CHINA AND MONGOLIA

Copyright, 1938
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The American Museum of Natural History

Published September 2, 1938
First Edition

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25841
NOV 25 '61

Made in the United States of America.

PUBLICATION NOTE

Because of the size of this report, treating as it does more than 500 forms of mammals, it has been found necessary to issue the volume in two parts, of which this is the first. Part 2, beginning with the typical rodents, will be brought out as soon as possible.

The Bibliography of the entire work appears at the end of Part 1; the Index will be at the end of Part 2.

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PREFACE

THE collections of Chinese and Mongolian mammals brought together through the field work of the Asiatic Expeditions of The American Museum of Natural History exceed any previously made, not only in the number of specimens secured, but also in the excellence of their preservation and the diversity of the localities which they represent. They form, therefore, a fairly adequate basis for a review of the mammalian fauna of these countries. In short preliminary papers, brief reports on this material have been published, group by group, during the past few years, with descriptions of species or races believed to be new. The present volume is intended to summarize our knowledge of the mammalian fauna of China and Mongolia and to serve as a handbook for the use of those interested. To this end, in addition to brief summary chapters, keys are given for the various orders, families, genera, and species, to facilitate the identification of specimens, while under each species or race in the systematic portion are given: the accepted Latin name, important synonymy, description of external and cranial characters, measurements, notes on nomenclature where necessary, the known facts of occurrence and habits within the area treated, and a list of localities from which specimens have been examined by the writer. While political boundaries usually form unsatisfactory units for the study of zoögeography, the general limits of China and Mongolia as set down in maps of the past decade have been taken, chiefly as a matter of convenience and partly because no significantly large collections have been available from without these limits. For these reasons, Korea and parts of Manchuria are excluded from consideration as well as the island of Formosa, the fauna of which, however, is essentially derived from that of the neighboring mainland.

It should be added that all specimens referred to as obtained by the American Museum Asiatic Expeditions include those collected by Dr. Andrews and his associates in the course of their explorations in Fukien and Yunnan in 1916-17, and again in northern Mongolia in 1919. These two expeditions were officially designated as the First and Second Asiatic Expeditions. All specimens collected in China and in Mongolia during the work of 1921 to 1930 are credited to the Central Asiatic Expeditions, known in the early years of the organization as the Third Asiatic Expedition.

In the preparation of this volume, a critical study has been made, to determine, so far as possible, the closer relationships of many eastern forms. Until recent years, it has frequently been the custom, at least among European naturalists, to give specific rank to mammals described as new, notwithstanding that the differences in comparison with other forms may be merely quantitative and the true relationships therefore much closer than between those forms differing qualitatively. An exaggerated conception of the number of distinct types or "species" is thus produced where relationships are really but subspecific and better expressed by a trinomial. To demonstrate this relationship satisfactorily, however, is often not easy and must necessitate in most cases a "revision" of several related forms. New names have frequently been bestowed on the basis of inadequate material; specimens of a single species prepared by different collectors at first sight often present slightly differing appearances; or differences of sex, age, season, or condition may mislead the investigator into regarding individuals of the same species as representing different races. Again, single specimens sometimes show individual peculiarities not duplicated in large series. A comparison with authentic material, types or topotypes, is often the only means of rectifying such mistakes, which are inevitable in the earlier stages of knowledge. Such steps are reflected in the synonymy of a species. It is too much to expect that all questions of relationship and nomenclature in the forms treated here are satisfactorily solved. Future workers will be able to correct many errors and extend the number of species or races known to occur within the limits of China and Mongolia. Nevertheless, in a general way it may fairly be said that the mammals of this area are now tolerably well known from a systematic point of view; many, however, remain rare in collections, while as to the more intimate points of life history we are still largely ignorant.

Throughout the preparation of this volume, I have had the hearty and unfailing coöperation of Dr. H. E. Anthony, Curator of Mammals, and of Dr. Roy C. Andrews, leader of the Asiatic Expeditions of The American Museum of Natural History, as well as that of other members of the staff. The collections of Chinese mammals in the Museum of Comparative Zoölogy, the Academy of Natural Sciences of Philadelphia, the University of Michigan, and at request, in the United States National Museum, have also been consulted. Through the aid of a grant from the Milton and Clark Fund of Harvard University, I was enabled in 1933 to spend several weeks at the British Museum, in the study of its unrivaled collection of historic specimens, types, and other material, without which it would have been impossible to correct many previous errors and misconceptions of my own and of other workers less fortunate. To all these institutions and their officers in charge, grateful thanks are due.

In listing specimens examined, it is understood that where no abbreviation follows, the numbers if given, are those of the American Museum of Natural History. Abbreviations are: A. N. S. P., for Academy of Natural Sciences of Philadelphia; B. M., for British Museum (Natural History), London; M. C. Z., for Museum of Comparative Zoölogy, Cambridge, Massachusetts; U. S. N. M., for United States National Museum, at Washington, D. C.; Univ. Mich., for Museum of Zoölogy, University of Michigan, Ann Arbor, Michigan.

The Bibliography at the end of Part 1 of this Volume includes all literature on Chinese and Mongolian mammals that I have come upon, except incidental references, through 1937.

Three new names are here proposed: **Aëretes,** a new genus for the flying squirrel *Pteromys melanopterus;* **Eospalax,** a new subgenus for the mole-rats typified by *Myospalax fontanierii;* and a new subspecies of Flying Squirrel.

The photographic illustrations are selected chiefly from the large series made in the course of their work by Dr. Roy Chapman Andrews and Dr. Walter Granger, to whom I would express my sincere thanks for the use of them as well as for much other help. The cut illustrating the nose-leaves of the horseshoe bats, *Hipposideros armiger* and *H. pratti,* has been generously lent by the Field Museum of Chicago, through the kind offices of Dr. Wilfred H. Osgood, in whose paper of 1932 it first appeared.

I am further indebted to Mr. Clifford H. Pope and Dr. Walter Granger of the American Museum of Natural History for many valuable notes, and particularly for their efforts to standardize the spelling of the place-names mentioned in the text. These so far as possible conform to the most modern usage as found in the List of Post Offices, thirteenth issue, Shanghai, 1932, and the Postal Map of China (Shanghai, 1920), as well as in other authentic sources.

For many species, outline maps of distribution have been prepared as text-figures, but it should be well understood that these indicate the range of each in only the most general way, for there are still vast areas in China and Mongolia in which little or no collecting has been done, so that often large sections of the supposed range are included on inference only, while on small-scale maps details of local distribution, although often sharply marked, cannot well be plotted. Nevertheless, such maps are valuable as enabling a better visualization of the known or supposed areas of distribution, while at the same time indicating something of the extent of our ignorance of them. No doubt many of these maps will be found subject to considerable later correction or elaboration as the mammalian fauna of the region becomes known in more detail.

Since the present report was written, many and great changes have taken place in the political organization of China and Mongolia, involving the re-

definition of certain of the former and more familiar provinces, so that in some cases their boundaries no longer coincide with those in use only a few years ago. Thus the western border of Szechwan is now drawn considerably to the eastward of its former course, so that specimens recorded from the well-known locality Tatsienlu are now to be regarded as from the new province, Hsikang, which stretches westward toward Tibet beyond the area covered in this book. The old province of Chihli, in North China, is now Hopei, and there are in addition the new provinces of Chinghai, Ningsia, Suiyuan and Chahar. All these changes are confusing, but have been taken account of in the distributional maps in the text.

I cannot too warmly express my indebtedness to Dr. Walter Granger, and his assistants, Miss Clara M. Beale and Miss Ruth Tyler, for the great care with which they have edited, checked and coördinated the manuscript, thereby correcting many minor errors that might otherwise have escaped me.

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SEPTEMBER 1, 1937.

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CHAPTER I

COLLECTORS OF CHINESE AND MONGOLIAN MAMMALS

THE first knowledge of the mammals of China and Mongolia by Europeans probably dates from the days of the Venetian traveler Marco Polo, who in the thirteenth century journeyed overland to the court of Kublai Khan and brought back parts of the Musk Deer (*Moschus*) which he seems to have met with on the western borders of those countries. Brief mention of other Chinese mammals is found in a few early works of travel, such as Du Halde's "Description de la Chine," 1735, which notices apparently for the first time the Mongolian Gazelle and the "Great Black Ape" or gibbon of Hainan; Peter Osbeck's "Voyage to China and the East Indies" (English edition, 1771) contains a "Faunula et Flora Sinensis," from which Thunberg (1823) copies a list of fifteen species of mammals, including "*Simia nemæa*," "*Sus sinensis*," "*Cervus alces*," and "*Cervus elaphus*." Pallas, too, who traveled in eastern Siberia in the latter half of the eighteenth century, described a number of species from near the borders of northern Mongolia that range into that country. The first important collections from China, however, did not reach Europe till much later. Among the earliest of these was perhaps that of John R. Reeves, who while stationed at Canton, sent back to the British Museum a number of mammals, of which J. E. Gray figured and named in his "Illustrations of Indian Zoology," *Canis procyonoides*, *Viverra pallida*, *Rhizomys sinensis*, and *Lepus sinensis*. This work bears the date 1830-34, but some of the plates are lettered 1829. Gray soon after (1837) described *Felis chinensis* and *Lutra chinensis*, and Ogilby, in 1838, *Cervus reevesii* from the same source. The botanist R. Fortune (1853) who made two visits to China before the middle of the last century (1843, 1844), also brought back a few mammals to the British Museum, which subsequently proved new or valuable.

Beginning about 1858, Robert Swinhoe, while on British consular service in China, took a very active interest in the zoölogy of that country and from time to time sent notes or specimens to the Zoölogical Society of London or to the British Museum. His work took him to Peiping, Chefoo, and Kalgan in North China, as well as to the island of Formosa, while later he was for some

time in residence at Amoy and again at Ningpo in South China, and also made collections in Hainan. His published communications on the mammals of eastern China and Formosa extend over a period of some sixteen years to 1874, and include descriptions of various new species.

By far the most outstanding figure among collectors of Chinese mammals is the Jesuit missionary, Père Armand David. He arrived in Peiping in July, 1862, and at once seems to have begun actively to make investigations and collections of the fauna. In 1864 he spent several months at Jehol, 200 kilometers north of Peiping, and in 1866-68 undertook a journey into what was then Chinese Mongolia, residing for some time at Saratsi, in northwestern Shansi. The collections he made, together with various specimens added by M. Fontanier, the French Consul at Peiping, were sent to the Paris Museum, where they were studied by Alphonse Milne-Edwards, who described various new species among them. David's most remarkable journey, however, was made about 1870 into the principality of Muping in Szechwan, then regarded as part of eastern Tibet. He was the first naturalist to reach these highlands, and in the course of nearly a year's work made an extraord nary collection of mammals, large and small, including many wholly new and unknown types as well as other species previously undescribed. These included the new insectivore genera *Anourosorex*, *Uropsilus*, *Nectogale*, and *Scaptonyx*, and the Golden Monkey, *Rhinopithecus*. The extraordinary zeal of this indefatigable collector resulted in bringing together at Paris a representation of Chinese mammals excelling any previously made. In August, 1871, these collections were on special view to the public at the Muséum d'Histoire Naturelle at Paris and were made by Milne-Edwards the subject of a magnificent volume with an atlas of colored plates—the well known "Recherches" (1868-74). David himself published several brief reports on his collecting journeys (see David, A., 1867-71, 1872-73, 1872, 1872a). He had many narrow escapes,—several attempts were made to poison him,—but he survived all dangers in a miraculous way. In the course of his work he was accompanied by a faithful Chinese servant, "Yellow Tom," whose memory Milne-Edwards essayed to perpetuate by naming in his honor a supposed new rat, "*Mus huang-thomæ*"! Later David visited Chekiang and Kiangsi Provinces, but collected mainly in other branches than mammals. In 1873 he spent three and a half months in the mountains of Shensi, not far from Sianfu, making additional collections, and in the same year journeyed to Kuatun in the mountains of northwestern Fukien, where again he obtained various species of exceptional interest, including the first specimens of the curious genus *Typhlomys*, described by Milne-Edwards, and still unknown from other parts of China. Here, too, he collected the first examples of the microtine later named by Thomas as *Microtus melanogaster colurnus*, and notes on the label of one (now in the British Museum), "*rubigin-*

osus n. sp.," but for some reason the name never was published. The locality became a famous one for naturalists: both C. B. Rickett and J. D. La Touche had collectors working there for several years (see Thomas, O., 1898, p. 769), and later it was visited by Mr. Clifford H. Pope, who secured an excellent collection for the American Museum in the course of the Asiatic work.

Mention should be made of the services of the French missionaries to science, for David was not alone in his interest in the mammals of China. Perhaps the foremost is P. M. Heude who in the course of a number of years from 1885-1901 published in his "Mémoires concernant l'Histoire Naturelle de l'Empire Chinois," a series of papers on the ungulates of China as well as on the bears and other species. His intense interest in the details of tooth structure led him to bestow technical names freely on many minor and individual variations in the skulls he brought together, resulting unfortunately in greatly burdening the nomenclature of many of these animals. His Sikawei Museum (now known as the Heude Museum) at Shanghai contains most of his type specimens, which have since been studied by Sowerby, while a general account of his life and work has been published by Courtois (1906). In Tatsienlu, Szechwan, several of the French missionaries have from time to time sent valuable specimens to the Paris Museum. Among others, the name of Monseigneur Biet is linked with his discovery of a striking species of *Rhinopithecus* and that of R. P. Dejean with the Yunnan Sambar Deer.

For many years following David's time, western China was very little visited by naturalists. In 1907-08 the late Walter R. Zappey accompanied the veteran traveler E. H. Wilson into Hupeh and Szechwan, making extensive collections of birds and mammals for the Museum of Comparative Zoölogy, and eventually reached Tatsienlu and the extreme edge of the Tibetan plateau at Ramala Pass.

Our first important knowledge of the mammals of extreme southwestern China is due to Dr. John Anderson (1879), who as naturalist and medical officer on two British expeditions from India to the borders of western Yunnan in 1867-68 and 1875, made collections in various branches of zoölogy, later embodying the results of his work in a sumptuous volume with atlas, giving descriptions and colored figures of many species. Most of these were previously known in part from Indian representatives.

Toward the close of the nineteenth century, Prince Henri d'Orléans undertook a journey from Tongking, across Yunnan to northern India, collecting a few mammals on the way, but not until comparatively recent years has systematic collecting been done in this province. The explorations of F. Kingdon Ward in 1911, 1913-14, 1921-22, among the great snow peaks of southwestern Yunnan, and the subsequent work of George Forrest in 1922, resulted in many interesting discoveries, which with lists of the species obtained have been

published by Oldfield Thomas (1922b, 1923). Meanwhile in 1916-17, Dr. Roy C. Andrews undertook the first of his Chinese expeditions, and accompanied by Mr. Edmund Heller, a skilled field naturalist, crossed Yunnan to Burma, returning with one of the largest and best prepared collections of large and small mammals ever made in this part of China. In the prosecution of this work in subsequent years, Dr. Andrews and his associates have done intensive collecting in various parts of China: eastern Szechwan, northern Hopei, northern Shansi, in the Taipai Shan of Shensi, and in Fukien. Mr. Clifford H. Pope has continued the work in the last-named area, visiting also the island of Hainan where large collections were made.

To the late Oldfield Thomas, Keeper of Mammals in the British Museum, must be given high credit for the interest he aroused among his countrymen stationed in various parts of China or traveling through it, so that for many years correspondents from various parts of this vast area continued to send to the British Museum from time to time specimens of large and small mammals. In this way Thomas built up a considerable representation of Chinese species at London, until in 1904 His Grace the Duke of Bedford undertook to finance the work of a trained collector for more systematic exploration. The services of Malcolm P. Anderson were secured and he was sent first to the Japanese islands and Korea, then to Shantung, the Mongolian plateau, Hopei, Shansi, Shensi, Kansu, Szechwan, and Yunnan. The results were briefly reported upon by Thomas in a series of papers from 1906 to 1912 and added greatly to a general knowledge of Chinese mammals. In some of this work Anderson was accompanied by Dr. J. A. C. Smith and Arthur de Carle Sowerby, who helped with the collection and preparation of specimens. The latter has himself done considerable collecting for both the British Museum and the U. S. National Museum, and through various popular books and more technical papers as well as in general articles in the China Journal (which he helped to found) has contributed greatly to furthering an interest in Chinese natural history, culminating in his recent successful attempt to establish a public natural history museum at Shanghai.

Several Chinese zoölogists are now taking an active interest in the fauna of their native land, among whom mention should be made of Chausu Mc-Amicus Shih, who has made several collecting journeys into the less-known provinces of southern China,—Hunan, Kwangsi and Kwangtung. Important collections were made in the last-named region by R. Mell, an Austrian botanist and naturalist, in the years from 1916-21. These were in part reported on by Matschie in 1922. Another expedition into China led by Stötzner, in 1916, was accompanied as naturalist by Dr. Hugo Weigold whose collections eventually reached the Dresden Museum and were reported on by Jacobi (1922). Weigold collected in northern Hopei, then proceeded up the Yangtze to the

PLATE I

The southern edge of the mixed forest zone, forty miles northeast of Urga, Outer Mongolia

Outpost larches at the edge of the forest zone, forty miles northeast of Urga, Outer Mongolia

Wa Shan region of Szechwan, previously visited by Wilson and Zappey. He finally reached Batang and northern Szechwan at Sungpan.

China has thus been traversed by many collectors, chiefly from east to west, less often in the opposite direction. It is impracticable to mention here the names of all those who have added to the knowledge of Chinese mammals, but it may be pointed out that there are still large areas from which little is known, particularly in the southern provinces, although the western highlands and the northeastern parts of the country may now be thought of as fairly well worked. The excellent report of Dr. W. H. Osgood on the mammals obtained for the Field Museum by the Kelley-Roosevelts and Delacour Asiatic Expeditions, chiefly in Tongking, indicates that many species are to be expected along the extreme southern border of China, which hitherto have been taken but a short distance only across that line.

Various Russian explorers have likewise done much to advance our knowledge of the mammals of Mongolia. Pallas in the latter half of the eighteenth century traversed Siberia, but his journey was mainly to the north of Mongolia. During the years 1855-59, Gustav Radde (1862) traveled extensively in Transbaikalia, several times crossing the border into northeastern Mongolia, making collections and observations on the fauna. His volume on the Mammalia is of importance as giving much data on the habits and distribution of many species common to both countries, including several forms which he named as new. His specimens went to the Zoölogical Museum of the Academy of Sciences at St. Petersburg (now Leningrad).

The four expeditions of Nikolai M. Przewalski into central Asia resulted in the discovery of many new mammals, which likewise were given to the Zoölogical Museum of the Academy. After his return from the last of these journeys, a special exhibition of these was held in the new wing of the Museum and a catalogue of the collection (in Russian) was printed, which included 702 mammals, 5,010 birds and 1,199 reptiles and amphibians. His first expedition, from 1871-73, extended across northern Kansu and Mongolia to Kalgan; the second, 1876-77, was chiefly concerned with an exploration of the Tien Shan area; the third expedition, 1879-80, slightly more to the south, was to the Nan Shan, Kansu, and southern Alashan; while the fourth, in 1883-85, was to the country between the plateau of northeastern Tibet and the Tarim basin. The zoölogical results of these explorations were in part published by the Academy, but of the mammals only the rodents were in part completed by E. Buechner, with a later monograph by Zalensky on Przewalski's Horse, discovered in the course of the third journey. The text, in Russian and German, is magnificently illustrated by a number of colored plates. Accounts of Przewalski's explorations were published by him in Russian with later German and English editions (see Przewalski, N. M., 1884; also the English edition translated by Morgan).

In 1884-87, an expedition to Kansu and northwestern Szechwan was undertaken by G. Potanin and M. Berezovski for the Russian Geographic Society. The former visited the Ordos Desert and northern Shansi, touching also Kansu and Mongolia, while the latter confined his efforts mainly to the region about Ssigu and the adjacent parts of Kansu and Szechwan. Except for the specimens obtained by Przewalski, these collections were the first to be made in Kansu and included among other rarities, the Golden Monkey and the Giant Panda, apparently secured through native hunters. Buechner, who reported on the mammals, regretted that most of them were given to the museum at Tomsk rather than to the larger institution at Leningrad. Other Russian explorers, including P. K. Kozlov in 1909 and 1924, as well as the brothers Grum-Grzimailo, who made a journey to western China shortly before 1907, have collected a number of interesting species in extreme western Mongolia, while in 1910-11 Douglas Carruthers, accompanied by J. H. Miller and M. P. Price, made a collecting trip for the British Museum, starting work at Minussinsk, Siberia, and working southeastward through the Syansk Mountains, crossed northwestern Mongolia, then proceeded westward through the Tannu Ola to the Great Altai and Barlik Mountains, northwestern Dzungaria, and along the Tien Shan to the Hami Mountains, and thence back to the Muzart valley, Kuldja, and Yarkand to India.

Of the extended work carried on by Dr. Roy C. Andrews in eastern and central Mongolia, resulting in the collection of fine series of the desert species, and in northern Mongolia where the edge of the northern forest brings in an entirely different set of species, a full account is given in the narrative forming the first volume of the present series. Especial credit is due Dr. Walter Granger, who in the intervals between his many other duties, collected and prepared a large part of the splendid series of Mongolian and also Chinese small mammals in the course of several years' work; also to Mr. Clifford H. Pope, whose intensive work in Hainan and Fukien resulted in large collections of small mammals from these important localities. Dr. Andrews himself worked in Fukien and in Yunnan with the aid of Mr. Edmund Heller in his earlier expedition and brought back a magnificent collection of the smaller species from these areas as well as a representative series of the larger mammals.

Sainnoin Khan, Outer Mongolia. Hills with patches of timber

CHAPTER II

FAUNAL AREAS OF CHINA AND MONGOLIA

THE vast area included within the political boundaries of China and Mongolia is roughly some 2,000 miles square and constitutes about one-third of the continent of Asia, between approximately 22 and 52 degrees of north latitude and 90 and 120 degrees of east longitude. A wide range of climatic conditions is thus presented, correlated not only with latitudinal but also with topographical and other factors. Proceeding from north to south, the mammalian fauna shows many striking contrasts between associations characteristic of one and another of these areas. On the other hand, some are wide-ranging species, such as tiger and black bear, and occur with but slight modifications under varying climatic conditions. The present distribution of the fauna is to be looked upon as the end result of many millions of years of changes, both climatic and geographic, some of them slow and by imperceptible degrees, others more rapid and spectacular. The composition of the fauna at any time is in part a result of the history of the area where it is found and in part a result of the food and other habitat preferences of the component species. If the local conditions undergo marked or gradual change, the species have three courses open: (1) they may gradually become adapted to the changes (evolution); (2) they may move off to other areas where the preferred conditions still continue (emigration); or (3) if appropriate response is impossible, they may remain and slowly die out as the changing conditions become more and more unfavorable (extinction).

The history of the mammalian fauna of eastern Asia during the long past may be in part worked out through the study of its fossils and must be left largely for the palæontologist. The present fauna of the area shows the following seven chief divisions: (1) the northern transcontinental forest which borders northern Mongolia, and to the east of the Khingan Mountains extends around the eastern edge of the Gobi to Manchuria and northeastern China; (2) the intervening Gobi, including not only the grasslands that form a long east-west loop around the northern and eastern edges of Mongolia, but also the more arid and strictly desert area of the central Gobi; (3) the northeastern part of China, including southern Hopei, Shantung, northern Shansi and Shensi, and Kansu, southward approximately to the borders of the Yangtze

basin or roughly latitude 34°; (4) South China, including the eastern part of the country from the Yangtze basin to the southern border, characterized by many species that prefer a milder climate, many of them, as one proceeds farther south, of chiefly tropical and subtropical distribution; (5) the western highlands, which begin at about the longitude of western Hupeh or eastern Szechwan, and include the latter province from the borders of Kansu and Shensi south through Yunnan and probably parts of Kweichow; (6) the subtropical border of extreme southern China; and finally (7) the edge of the Tibetan plateau along its extreme eastern border, where it meets the western highlands of Szechwan.

1. *The Northern Forest Fauna:*—The mixed evergreen and hardwood forest of north temperate latitudes is practically continuous across northern Europe and Asia from the limit of tree growth southward. In the east the southward limits are somewhat restricted by the arid conditions of central Asia, so that it becomes more or less broken. The edge of this forest follows along the northern edge of Mongolia, giving way rather abruptly to the open grasslands and the more barren stretches of the Gobi; but to the eastward of the north-south Khingan Range it continues farther down across Manchuria to northern and central Hopei. In a general way it corresponds to the boreal forest of the Canadian Zone in North America.

Prominent among the northern trees composing this mixed forest are larch, fir and pine as well as oaks and birches. It carries with it a rather characteristic series of mammals, many of them with closely similar representatives in northern and central Europe, and in diminishing number, in northern North America. Among these, the insectivores are few, chiefly two species of small shrews (*Sorex araneus borealis* and *S. buxtoni*) and probably *Neomys* (as yet not known from Mongolia but recorded slightly north of its borders), as well as a race of the European hedgehog (*Erinaceus*); bats are represented by several species of the family Vespertilionidæ, belonging to the genera *Myotis*, *Eptesicus*, *Plecotus*, and *Vespertilio*, closely resembling corresponding European forms; the carnivores include the Brown Bear, Red Fox, the wide-ranging Wolf, the Ermine, and Pygmy Weasel (*Mustela rixosa pygmæa*), Badger (*Meles*), Otter (*Lutra lutra chinensis*) and Lynx (*Lynx lynx isabellina*). These are associated with various northern rodents, including varieties of the European Tufted-eared Squirrel (*Sciurus vulgaris*) and the small northern flying squirrel (*Pteromys volans buechneri*) in the mixed forest, and in the more open parts the Eversmann's Spermophile (*Citellus eversmanni jacutensis*). Beaver just reach the edge of Mongolia in the southern extension of the forest, but doubtless were formerly more widespread. In suitable situations the Mouse-hare (*Ochotona hyperborea mantchurica*) is found southward into this part of Mongolia, but the genus, although represented in western Europe

Pass to the Mongolian Plateau at Kalgan

Mongolian Plateau above Kalgan, showing Chinese cultivation

in glacial times, has since died out in that continent. Other characteristic rodents are: the Red-backed Lemming (*Myopus*), the Field Vole (*Microtus mongolicus* representing the European *M. arvalis*), the red-backed mice (*Clethrionomys*), of two and perhaps three species corresponding to those of northern Europe, while of larger ungulates, the Pig, Elk or "Moose," the Red Deer, and the Roe Deer are represented by forms differing but very slightly from their European relatives. Most of these species continue across to the Pacific coast following the northern forest and skirting the edge of northern Mongolia. To the southward the limit for most of them is fixed by the intervening Gobi which extends eastward from the arid wastes of central Asia, and forms an effectual barrier. A few, however, such as one of the red-backed mice, flying squirrel, roe deer, appear again in northern China on the other side of the desert, having perhaps skirted its eastern end, following the forested parts east of the Khingan Range into Manchuria and northern Hopei. To the south and west of Peiping or thereabouts, the conditions are more arid and the forest broken, perhaps due in part to human destruction, making such a passage more difficult. Here, too, the northern-forest fauna appears to reach about its natural limit, and meets the species of more southern range that find their bounds in these latitudes.

2. *The Gobi:*—The fact that most of the boreal forms of mammals characteristic of the Mongolian forests do not reappear on the south side of the Gobi and are not found as relict colonies at high altitudes farther south, seems evidence that these species, if driven south by the cold of the glacial period, were unable to cross the intervening desert, which, therefore, must have existed for a very long period, forming an effective barrier to the forest-living types except those that were able to circle the eastern end. The Gobi forms a long tongue of desert extending eastward from the central Asiatic deserts, bringing in with it a series of mammals, particularly rodents, that have become adapted for desert life in a remarkable degree, implying a very long period of evolution in that type of environment. This arid area is more or less continuous from northern Africa, but most of the genera represented are of Asiatic affinities. The general east-west trend of the higher mountain chains enclosing the western end of the Gobi is perhaps a factor in permitting this extension of the desert by interposing a less effective barrier against the prevailing winds to extract their moisture.

In the narrative volume of these reports, Dr. Roy C. Andrews and Dr. Walter Granger point out that the Gobi is not equally desert throughout, but that a broad belt of grasslands forms a wide, flat border around its northern, eastern and southeastern ends, while the central portions are much more arid or truly desert. Thus in crossing from southeast to northwest—Kalgan to Urga—one first passes through the southern grassland belt, then traverses the

dry desert country of the central Gobi to Tuerin, where one emerges upon the northern grasslands, over which the caravan track proceeds until the forest edge is reached in northern Mongolia. These three divisions differ in their fauna. Characteristic of the southern grasslands are the Mongolian Gazelle (*Prodorcas gutturosa*) and the small spermophile (*Citellus dauuricus mongolicus*), which extends its range southward over parts of northern China. In the northern grasslands the spermophile is replaced by a larger species (*C. pallidicauda*). It is here, also, that the colonies of Bobac Marmot (*Marmota bobak sibirica*) are found (related to the form of central Europe), while preying upon them and the spermophiles is the Masked Polecat (*Mustela eversmanni tiarata*), corresponding in this relation to the Black-footed Ferret of North America, that frequents the colonies of "prairie dogs." Brandt's Field Vole (*Microtus brandti*) is abundant as well as *M. poliakoffi*, while a third species (*M. tianshanicus angustus*) is rarer. Both the latter are members of the subgenus *Stenocranius*. The small hamster (*Cricetiscus songarus campbelli*) is a characteristic grassland species of both the southern and the northern portions.

Extreme northwestern Mongolia is inhabited by several species that seem to be absent from the rest of the country. Among these are Przewalski's Horse, which just reaches this area from farther west, and the vole (*Microtus agrestis mongol*) representing the group so widespread in North America, with an additional postero-internal loop on the middle upper molar. The large jerboa (*Allactaga*) is found over much of Mongolia, but the smaller genus (*Alactagulus*) has thus far been taken in the far northwestern part of the country only. The Mouse-hare (*Ochotona alpina*) also reaches this end of Mongolia from the west. Notable also is the extension of the Mountain Sheep (*Ovis ammon darvini*) and the Siberian Ibex (*Capra sibirica*) into the central Gobi, following the northwest-southeast trend of the mountain chains into the central part of the desert. It was perhaps by following these ranges that the sheep crossed to northern Shansi, and perhaps in former times extended into Shantung, but the ibex apparently did not penetrate so far, although both are found together in the western Gobi.

The typical desert country occupies the central part of Mongolia and is largely barren and dry, as well described by Dr. Roy C. Andrews in the first volume of this series. Water is scarce, forage is sparse and cover hardly available over great stretches. Yet a number of mammals are more or less confined to this desert. Of larger species the wild ass and the gazelle (*Gazella subgutturosa hillieriana*) are confined to this environment, the former sometimes gathering into considerable herds, but the latter consorting in small groups. Wolves are rare, and two species of fox, one a representative of the widespread Red Fox, the other resembling the American Kit Fox, are present in small numbers. One or two types of desert-living cats (*Felis manul* and probably

The Gobi. Looking out over the valley of Tsagan Nor, from just below Baga Bogdo, Outer Mongolia

Felis bieti=pallida) must find at times abundant food in the shape of small rodents, such as the various species of jerboa and Przewalski's Vole (*Lagurus przewalskii*). A burrowing adaptation of the microtine type is found in the genus *Ellobius*, of which forms closely allied to those of western and central Asia have penetrated well into this desert, where they have sought shelter through an underground existence. The small hamsters, *Phodopus*, have similarly developed subterranean habits, burrowing in the sand hills, and in correlation with these habits have nearly lost the tail and are extremely pallid in color. Most interesting of all are the various genera of leaping rodents that have developed the saltatorial habit in correlation with desert living, and have become long of foot and limb, with long tails and, usually, much enlarged audital bullæ, sometimes associated with long external ears as in *Allactaga* and *Euchoreutes*, or with short ears as in *Dipus*, *Salpingotus* and *Cardiocranius;* all are characteristic of sandy deserts, developing stiff hairy pads under the toes for giving a secure footing on the shifting sand. Hares (*Lepus europæus tolai*) are common over parts of the Gobi as well as in North China, with the palest of the races in the desert. They often haunt old camp sites along the caravan track. Pallas's Mouse-hare (*Ochotona pallasii*) lives among rocks in the desert, as does also the Cliff Mouse (*Alticola*) and a desert race of a northern bat (*Eptesicus nilssonii gobiensis*) while the Dauurian Mouse-hare makes burrows out in open grassy places. Hedgehogs of the long-eared group (*Hemiechinus*), very pale in color, take the place of the short-eared *Erinaceus* of the northern fauna, while shrews are almost lacking, although a single specimen of a pale form of *Crocidura* (*C. ilensis lar*) was taken by the expedition at Tsagan Nor.

3. *North China:*—South of the Gobi and its extension the Ordos Desert, is a wide stretch of country comprising the northern parts of Kansu, Shensi, and Shansi, and the southern portion of Hopei, over which the conditions are semiarid, with occasional mountain ranges, partly wooded. Malcolm P. Anderson (in Thomas, 1909, p. 964) writes: "The provinces of Shan-si and Shen-si are quite different in character. The former may be briefly described as a mountainous country with occasional large upland plains. Some peaks in Shan-si rise above 10,000 ft., and are massive rocky mountains with only a comparatively thin coating of loess soil. Where the loess figures mostly is in the plains, of which that of Tai-Yuen-Fu, that of Ta-Tung-fu, and that of Hsiu-clou are the best examples. The streams of Shan-si flow only in the rainy season, with the exception of the larger rivers. Northern Shen-si, on the other hand, is a region of loess hills of almost uniform height; the skyline of Shen-si, seen from the mountains of its eastern neighbour, is a straight line declining very gradually as it passes from north to south." Of the mammals of this area, some are of northern transcontinental types, which may have

reached this area either by extending their range around the eastern edge of the Gobi, or in case of species with a slightly more southern tendency, by having been able to spread widely east and west across the less barren parts of central Asia, in recent or earlier times.

An interesting example is *Clethrionomys rufocanus shanseius*, the only one of the red-backed mice yet found in the area south of the Gobi, occurring in the spruce forests of northern Shansi. Another example is the northern flying squirrel (*Pteromys volans buechneri*), which probably occurs in northern Mongolia, but hitherto is recorded only in Kansu and the forests of southern Shensi of the present area. The chipmunks (*Eutamias*) have a rather similar distribution, for they are found in the open forest of northern Mongolia, around the eastern parts of the country, to Hopei, Shansi, Shensi, and Kansu. In a general way, these and a number of other species are limited in their southward range by the east-west mountain ranges—the Min Shan in southern Kansu, and the Tsingling of southern Shensi and Shansi—and the northern borders of the Yangtze basin, with slightly differing limits in accordance with their particular requirements. Thus among the Insectivora, the mole genus *Scaptochirus* is characteristic of northeastern China; the hedgehog of this region is a close relative of the Eurasian species *Erinaceus europæus*, while the shrews of both red-toothed (*Sorex*) and white-toothed (*Crocidura*) types are rare, *Sorex sinalis* being known from Kansu, the small *Crocidura ilensis shantungensis* representing the latter genus in the northeast. The hamsters, including the larger *Cricetulus triton* group and the smaller *C. barabensis* races, do not extend south of these limits. Gerbils of the two species *Meriones unguiculatus* and *M. psammophilus* are both common in North China, and are partial to semi-desert. The mole-rats of two types are characteristic northern animals, the more northern *Myospalax myospalax psilurus* extending southward from extreme northeastern Mongolia into Hopei, the more southern *M. fontanierii* ranging south into Hupeh and northern Szechwan at high altitudes in slightly differing races. Other northern species, whose range is transcontinental in the north temperate zone and extends to northern China, include the Roebuck (*Capreolus*), the Red Deer (*Cervus elaphus kansuensis*), the Badger (*Meles meles leptorynchus*), the Otter (*Lutra lutra chinensis*), the Wolf (*Canis lupus chanco*), the Wild Boar (*Sus scrofa* subsp.) and various rodents such as voles of one or two species (e.g., *Microtus ratticeps flaviventris*), the Brown Rat (*Rattus norvegicus socer*), the Harvest Mouse (*Micromys*), and the small House Mouse (*Mus bactrianus* races). Other species of North China have a more restricted range, at least in modern times, and are peculiar to this part of China, though no doubt with once a wider range. Such are the River Deer (*Hydropotes*), confined in China to the Yangtze River bottoms but turning up once more in Korea; David's Deer (*Elaphurus*) the antlers of which

are associated with ancient human culture in Honan; and the Groove-toothed Flying Squirrel of the forests of Hopei. On the other hand, sundry species whose distribution is essentially southern here find their northern limit, as the Striped Tree Squirrel (*Tamiops s. vestitus*), the Large-toothed Flying Squirrel (*Trogopterus*), the common Yellow-bellied Rat (*Rattus confucianus chihliensis* and other races) and *R. nitidus humiliatus*. This meeting of the northern and the southern faunas is paralleled to some degree in North America.

4. *South China:*—In a general way the parallel of about 34° north marks the southern limit of the North China fauna, while south of that, from about the northern edge of the Yangtze drainage and the Tsingling Range, southward, this gives place to a more numerous assemblage of species whose distribution is largely southern, and corresponds in a general way to the austral fauna of North America. Many of the species are wide-ranging across the whole of southern China, while others are more strictly confined either to the lower country of the eastern parts or to the highlands of the western portion. One may thus distinguish the South China fauna and that of the western highlands. Of those species that are wide-ranging longitudinally and altitudinally, it is usual to find that the highlanders represent a more or less differentiated race from those of the lower coastal districts of southeastern China. There are thus subspecies of various bats in the lower country of South China differing subspecifically from their representatives in the west, as *Rhinolophus blythi calidus* and *R. b. szechwanus*, *R. episcopus caldwelli* and *R. e. episcopus* of east and west respectively, *Myotis chinensis* and *M. c. luctuosus*, and among rodents many others might be mentioned of the genera *Dremomys*, *Callosciurus*, *Sciurotamias*, *Petaurista*, *Eothenomys*, *Rhizomys*, *Rattus*, *Mus*, among the Carnivora the widespread weasels *Mustela sibirica* and *M. alpina*, and among ungulates the genera *Capricornis* and *Nœmorhedus*, in all of which examples are found of subspecific differentiation into races characteristic of lowland and highland of eastern and western China.

A number of other species or genera are not found in the western uplands but are confined to the southeastern lowlands. Such are the moles of the genus *Mogera* of Fukien and Hainan, the ferret-badgers (*Helictis*), the Crab-eating Mungoose (*Herpestes urva*), the Clouded Leopard (*Felis nebulosa*), the Scaly Anteater (*Manis pentadactyla dalmanni*), the distribution of which is doubtless largely governed by that of the termites on which it feeds, the curious Tufted-tailed Dormouse (*Typhlomys*), the Red-cheeked Squirrel (*Dremomys rufigenis pyrrhomerus*), Reeves's Muntjac and the Tufted Muntjac (*Muntiacus reevesii* and *M. crinifrons*). Perhaps the common Rhesus Macaque (*Macaca mulatta*) might be included here, although it ranges across extreme southern China, and even reaches considerable altitudes in parts of Szechwan.

The Sika Deer (*Cervus nippon boschi*) is another example of a species characteristic of southeastern China, although represented also in Korea. The genus *Rattus* is found chiefly in warmer countries of the Old World and is represented in South China by a number of species which do not go much beyond the Yangtze basin in the east, although occurring also in the western highlands, such as *R. losea*, *R. edwardsi*, *R. bowersi*, and others.

With all these more southern species the limits of northward distribution vary slightly in each case, but as a whole they represent a very distinctly austral element.

5. *The Western Highlands:*—By far the most interesting and remarkable of the faunal divisions of China is that of the western highlands, from approximately southern Kansu and southern Shensi southward to include Szechwan and parts of northern Yunnan and probably Kweichow. This great area is well watered and mountainous, many of its ranges extending up to ten thousand feet or more, with many peaks even in western Yunnan running to 13,000 feet and perpetually snow-capped. The northern boundary is marked approximately by the east-west ranges of the Min Shan (in Kansu) and Tsingling (southern Shensi), but on the west the mountain chains of the Szechwan and Yunnan borders trend north and south, thus opposing a barrier against the westerly winds and, by condensing moisture from these air currents, producing an abundant rainfall with its consequent forest growth. The forests are largely of fir and spruce with hardwoods at middle levels, but in the higher parts, 8,000 to 10,000 feet, the growth is lower, and is characterized by thickets of small bamboo and rhododendron. The north-south ranges of western China are believed to be older geologically than the east-west Himalayas with which they are contiguous, and seem to have afforded asylum for many peculiar, often primitive, types of mammals not known elsewhere to-day. On the other hand, their contact with the Himalayas allows a certain interchange or extension of range for some of the faunal elements, as in the case of such genera as *Soriculus*, *Nectogale*, *Chimarrogale*, *Ailurus*, *Budorcas*, *Nœmorhedus* and others, which are present in the Chinese highlands and in the eastern Himalayas. Peculiar to the former, are the following genera: among insectivores, *Uropsilus* and the related *Rhynchonax* and *Nasillus*, the more mole-like *Scapanulus*, and the shrews, *Blarinella* and *Anourosorex* (the latter extending into India); of the primates, the Golden Monkey (*Rhinopithecus*); of carnivores, the Giant Panda (*Ailuropoda*); of rodents, the Rock Squirrel (*Rupestes*), and the Jumping Mouse (*Zapus*), notable for its close relationship to the American *Zapus*, as well as the subgenus *Neodon* of *Microtus*. The voles of the genus *Eothenomys*, although extending in mountainous country to the coast ranges of Fukien and westward to the borders of Burma, are essentially characteristic of these highlands, as are also the mouse-hares, *Ochotona thibetana* and its races, a

Yenchingkou near Wanhsien, eastern Szechwan. Site of bat caves; the limestone ridge in the background is the haunt of Edwards's Giant Rat (*Rattus edwardsi gigas*)

forest-dwelling species, and possibly *O. gloveri* of the mountainous parts of western Szechwan.

The presence of a mole of the genus *Talpa* (*T. longirostris*) here is interesting, as its affinities are more western, so that it possibly entered China by way of the Himalayan chain. In the opposite direction, a number of species seem to have spread into the Himalayan region, or to have been indigenous there. Thus the Takin and the Goral as well as the Serow reach their western limit in the Bhutan region; the shrews of the genera *Soriculus* and *Nectogale* as well as *Chimarrogale* occur in the Himalayas; the small Panda (*Ailurus*) is found there also, but not the Giant Panda; the widespread *Rattus fulvescens* extends into Nepal.

It is interesting to find that the lofty mountain masses of Yunnan and parts of Szechwan that reach altitudes of over ten thousand feet with perpetual snow at their summits, show very little in the way of special alpine species. This is apparently because even during the Pleistocene period there was no way whereby boreal mammals, if pushed south by the advancing glaciers in the north, could cross the east-west deserts of the Gobi and central Asia, for the lack of north-south mountain chains afforded no such highway for migration as we see, for example, in western North America, where boreal types of birds and mammals occur on the upper levels of the Sierra and Rocky Mountains, far south of their sea-level distribution. Perhaps in part because of this lack of competitors, in part because of favorable conditions of climate and food, these western highlands have remained to the present the home of many annectant or peculiar types that have elsewhere died out. Thus the genus *Neotetracus* may be thought of as an ancestral member of the Erinaceidæ; *Uropsilus* is a primitive shrew-like member of the Talpidæ; *Parascaptor* is perhaps a relative of the American mole *Parascalops; Eothenomys*, with its subgenera *Anteliomys* and *Caryomys*, shows many intermediate characters from which more advanced types of microtines may have developed, while the subgenus *Neodon* is practically a *Pitymys* without fossorial modifications. The absence of the latter genus from China is noteworthy. *Zapus* in these highlands is a relict, having died out elsewhere in the Old World, and the raccoon-like *Ailurus* is an annectant genus of the Procyonidæ that has survived here but disappeared elsewhere. The three genera of goat-antelopes (*Budorcas*, *Capricornis*, and *Nœmorhedus*) all occur together here as more primitive members of the Bovidæ, represented elsewhere only by the Rocky Mountain Goat, and perhaps by the musk-oxen in America. Hemmed in by deserts on the north and west, and by low country on the east, the south has been the main source of intrusives, and these include for the most part species or genera whose main area of distribution is at lower and warmer latitudes (for example the Rhesus Monkey and Sambar Deer).

6. *The Subtropical Fauna:*—While the mammals of southern China are mostly of warmer-country types, often with wide longitudinal and latitudinal distribution, there are a number of species of distinctly more tropical preference, that just reach the southern edge of the country or penetrate a short distance beyond its borders. These may be regarded as constituting a subtropical element, which appears in extreme southern Yunnan, Kweichow, Kwangsi, and Kwangtung Provinces and in the island of Hainan. Of such are the tree-shrews (*Tupaia*), represented by local races of the single species *T. belangeri*, in Yunnan and Hainan, as well as the shrew-like *Hylomys* and *Neotetracus* in the former; other insectivores include the peculiar mole, *Parascaptor* (Yunnan), and several species of white-toothed shrews (*Crocidura*); a larger number of bats of tropical and subtropical distribution, including two genera, *Cynopterus* and *Rousettus*, of fruit bats; and various Microchiroptera, as *Taphozous*, an emballonurid; *Lyroderma*, a megadermid; species of *Hipposideros* and *Triænops* of the Hipposideridæ; *Tylonycteris*, *Scotophilus*, *Scotomanes*, and *Kerivoula* of the Vespertilionidæ; and *Chærephon* and *Nyctinomus* of the Molossidæ. At least three species of langur monkeys (*Pithecus*), and the gibbons (*Hylobates hoolock* and *H. concolor*), just enter the southern borderland, the last on the island of Hainan; possibly, too, *Macaca assamensis* and the Stump-tailed Macaque (*Lyssodes*) should be regarded as intrusives from the subtropics. Among the Carnivora there are a number of subtropical species such as the Lesser Ferret-badger (*Helictis taxilla sorella*), the Indian Otter (*Lutra tarayensis* from Yunnan), two species of palm civets of the genus *Paradoxurus*, one of which (*P. minor exitus*) barely reaches the southeastern border, the other (*P. hermaphroditus laotum*) occurring in Hainan; mungooses (*Herpestes*) of two species, one in Hainan, the other (*H. urva*) more widely spread across the mainland of extreme southern China. Many rodents might be added to this list, including the giant squirrels (*Ratufa*, in Yunnan and Hainan); several flying squirrels, large and small, as *Petaurista hainana*, *P. yunnanensis*, *P. punctatus marica*, *Pteromys* (*Petinomys*) *electilis* (Hainan) and *Belomys pearsonii;* the mole-rat (*Rhizomys pruinosus*) just reaches southwestern Yunnan and is of more southern distribution than *R. sinensis* and its races, while other genera include such subtropical mammals as *Leggada*, *Bandicota*, *Vandeleuria*, *Chiropodomys*, and *Hapalomys*, members of the Muridæ, a family of essentially warm-country distribution. Among the ungulates, the larger muntjacs (*Muntiacus vaginalis muntjak* in Yunnan, and *M. v. nigripes* in Hainan) may be included as subtropical species, as well as the Panolia Deer (*Rucervus platyceros hainanus*). There is some evidence that in former times elephant and rhinoceros may also have reached the southern borders of China.

No doubt future work will add considerably to this list, for the southern provinces, except Yunnan, have not been thoroughly collected.

Dr. Andrews's camp and the Snow Mountain, western Yunnan, 12,000 feet

The Mekong valley, western Yunnan

7. *The Tibetan Plateau:*—On its extreme western border, China includes the eastward edge of the great Tibetan plateau. The traveler emerges from the high passes of the Szechwan highlands, as near Tatsienlu, on the ancient caravan trail, upon more open country, broken, yet scarcely mountainous, sparsely covered with grass and scattered vegetation, partly watered by swift narrow streams, trending northwest to southeast, some of which unite to form the Yangtze River flowing eastward to the Pacific Ocean, while others, turning southward, form a series of deep, narrow and nearly parallel valleys transecting western Yunnan. This plateau is semiarid and supports a characteristic fauna, although the species of mammals are relatively few, and include only such as can withstand the rigorous climatic conditions and find subsistence there. The following species are known from the borderland of China and range westward into Tibet: the Black Grizzly Bear (*Ursus pruinosus*) which subsists in part upon the burrowing mouse-hares that it digs up; of these, the red-eared species (*Ochotona erythrotis*) is found on the high mountains of western Szechwan; the Gray-tailed Hare (*Lepus oiostolus*) and races which occur along the western edge of Szechwan and Kansu; the Himalayan Marmot (*Marmota himalayana robusta*), hardly if at all distinguishable from the animal of the more western Himalayas; and several larger hoofed mammals, including the White-lipped Deer (*Cervus albirostris*), remarkable for its rough coat, the Tibetan Gazelle (*Procapra picticaudata*), which ranges northeastward into Kansu, where it is represented by a closely similar race, Przewalski's Gazelle (*P. picticaudata przewalskii*), the Blue Sheep (*Pseudois nayaur szechuanensis*) with a like distribution, and probably too, the Wild Yak, which is known to occur close to the borders of Szechwan, and slightly farther north enters Chinese territory in northwestern Kansu. Possibly the Bactrian Camel was originally part of this fauna. Future investigation will doubtless show that the Snow Leopard (*Uncia uncia*), a species of these barren heights, also enters Chinese territory in the extreme west of Szechwan, for, although no specimens seem to have actually been taken in the province so far as recorded, it is well known to range across Tibet at higher levels, preying on young wild sheep and ibex, while the skins are frequently traded across into China. No doubt a few additional species will eventually enlarge this list.

CHAPTER III

FAUNAL RELATIONS OF ASIA WITH NORTH AMERICA

A CERTAIN obvious similarity between the fauna and flora of northern Eurasia and those of northern North America has led zoögeographers to unite both in a single major division, the Holarctic Region. So far as the mammals go, however, this likeness is most marked amongst the boreal types of the arctic regions and of the transcontinental evergreen forest belt, southward of which the community of mammalian forms becomes less and less evident or is almost completely lost. This seems to indicate that the last land connection by way of northeastern Asia and Alaska, along which interchange must have taken place, was far to the northward and of relatively narrow extent, so that only species of northern distribution were enabled to cross from one continent to the other. The effect of a continuous land bridge of this sort would be to shut out any arctic current bringing cold water from the north through Bering Strait, while the warm Japanese Current washing its southern shores would perhaps affect but a narrow strip along its southern edge, bringing to it a warm, moist climate such as at present obtains along the shores of Alaska, British Columbia, and the State of Washington. The abundant moisture favors forest growth, so that mainly forest-living species might be expected to take advantage of the connection to make the crossing. On the other hand, "the shutting off of the warmer southern currents from the polar region probably marked the commencement of a cooler northern climate" (Osborn, H. F., "The Age of Mammals," 1910, p. 244). There is evidence that such a connection existed in early Pleistocene times and lasted till near the end of the glacial period, when Asia and North America were again completely separated. At an earlier epoch, in the Pliocene, there was a similar connection between the two continents, with evidence of a generally warmer climate farther to the north which would have enabled species of more southern latitudes to make the crossing, while a cooler climate in the north during subsequent times must have forced many of these southward to more congenial conditions. In the present distribution of eastern Asiatic mammals, there seems to be indication that at least two such periods of interchange took place, and as one would

expect, the species of the earlier immigration are found farther to the south than those of the later one.

The living species of mammals in northern Asia are in many cases represented in northern North America by forms so closely similar that the differences are hardly if at all more than of subspecific value. In other cases, however, those of one continent are not now represented in the other, although there may be evidence of their former presence in the shape of fossils, as in the case of the musk-ox, once of circumpolar distribution, but now confined to Greenland and northern Canada. When the forest fauna of northern Mongolia is compared with that of the "Canadian Zone" of North America, its New World equivalent, many such correspondences appear, together with a smaller number of disharmonies.

Among the Insectivora, the Saddle-backed Shrew, *Sorex araneus borealis*, is represented in northern America by the very similar *S. arcticus* group which is found from Alaska to Nova Scotia, but it seems uncertain whether *S. minutus* or *S. buxtoni* has a similar New World relative. Among the bats, the Eurasian *Myotis daubentonii* is doubtless the counterpart of *M. lucifugus*, which reaches tree limit from Alaska to Labrador, but other species are for the great part more southern in distribution. Among these the short-nosed *Myotis frater*, described from Fukien, seems to be the Chinese representative of *M. volans* of western North America which ranges northward to extreme southern Alaska. Possibly at some former time the range was continuous across an ancient land bridge so that under very little warmer conditions the common ancestor was able to extend farther northward, although since then the increasing cold has forced the modern descendants somewhat to the south of those latitudes. The close correspondence between the small-footed and long-haired *Myotis muricola moupinensis* with its peculiarly dark-based fur and contrasting reddish tips, and the western American *M. californicus* group suggests a near relationship, and perhaps again indicates that the latter were derived from this Asiatic stock at a time when land connections and slightly warmer temperatures in the north made it possible for the species to cross from the Old to the New World. The present northward distribution of the two shows a wide gap from the Chinese highlands to extreme southern Alaska, for as in the previous case, the climatic conditions in eastern China are now more rigorous than in corresponding latitudes of the southern Alaskan coast. The interchange perhaps goes back to Pliocene times.

Turning to the Carnivora, similar correspondences occur. An outstanding case is that of the family Procyonidæ, the raccoons and their kin. At the present time the group is well represented in tropical America, with a single species of *Procyon* extending northward in the United States to southern Canada in forested areas. Its only representative in Asia is the small Panda

(*Ailurus fulgens*) at present confined to the highlands of southwestern China and the adjacent portions of the Himalayas. There must have been a time, probably far back in the later Tertiary, when the group was more widespread, and a land connection in the north enabled the ancestral forms to cross from one continent to the other. A similar case is that of *Zapus* to be mentioned later. Other eastern Carnivora show even closer kinship with American species. Thus the northern Brown Bear (*Ursus arctos lasiotus*) seems a close relative of the American Grizzly, with similar pale shoulder markings, and *Euarctos thibetanus*, in spite of its larger size, can hardly be other than the Asiatic representative of the American Black Bear (*Euarctos americanus*) with a comparable wide range from northern Mexico to Alaska. This latter fact and the marked size difference may indicate that the American animal came with an older emigration than Pleistocene, although the first presence of bears in America is supposed to be in relatively late Tertiary times. The Red Fox (*Vulpes vulpes* subsp.) and the Wolf of northern Asia are so similar to those of northern North America as hardly to merit specific distinction from their New World congeners, implying a separation of relatively short duration, although the canids are on the whole conservative types. The Old World Ermine (*Mustela erminea* and races) finds its counterpart in the closely similar *M. cicognanii* of northern North America, a species characteristic of the evergreen forest area, while the Pygmy Weasel (*M. rixosa pygmæa*) is clearly but subspecifically related to the *M. rixosa* and races of the same area. Probably, too, the Sable (*Martes zibellina* and races) stands in a similar relation to the American Pine Martens (*M. americana* and races), but the Beech Marten (*M. foina*) is not represented in the New World. The lynx of northern Mongolia (*Lynx lynx isabellina*) is replaced in the evergreen forests of Alaska by the Canada Lynx, at present regarded as a distinct species but perhaps of closer relationship than this implies.

Coming to the rodents, the tree squirrels show a striking contrast, for *Sciurus vulgaris* (and races) of the transcontinental forest of Eurasia has no close relative in the evergreen belt of America, but its place is occupied by the smaller red squirrel (*Tamiasciurus*). The flying squirrel of the northern Asiatic forests (*Pteromys volans* subsp.) is currently regarded as generically distinct from its counterpart (*Glaucomys sabrinus*) of the American fur countries, but the differences are probably best considered at most of subgeneric value. On the other hand, the common ground squirrel of northern Mongolia (*Citellus eversmanni jacutensis*) is so closely similar to the Alaskan members of the *C. parryi* group that the relationship can hardly be more than subspecific, and the chipmunks (*Eutamias*) are evidently near relatives on both sides.

Among the microtines are several interesting contrasts. Thus, of the red-backed mice (*Clethrionomys*), forest-living species, the two species of northern

Mongolia are represented in Alaska by but one (*C. dawsoni*), for the *C. rufocanus* type is not known from the New World.

In the meadow mice (*Microtus*), the common form of northern Asia is of the *M. arvalis* type, represented in northern Mongolia by *M. mongolicus*, with but four prisms in the second upper molar. This type is found in North America represented by *M. operarius* of Alaska, with a similarly formed second upper molar. It has apparently not extended far into the continent, for elsewhere over most of Canada and the United States *Microtus pennsylvanicus* is the dominant species with an additional postero-internal loop on the second upper molar. This latter type is represented in northern Europe and Asia by *M. agrestis*, of which *M. a. mongol* is the Mongolian race. The abundance of this type in North America to the exclusion of the *M. arvalis* type may be evidence that it was the first to reach the New World or that it may have reached the Old from the New.

An interesting parallel in association is found in the Bobac Marmot of the Mongolian grasslands, which is more or less colonial and has a special enemy in the Masked Polecat (*Mustela eversmanni tiarata*). In this relation it is similar to the American prairie dogs (*Cynomys*) which find in the related Black-footed Ferret (*Mustela nigripes*) a particular enemy. The two hosts are not very closely allied, but the predators are.

Of the mouse-hares (*Ochotona*) only one of the three Asiatic subgenera is represented by the various forms of western North America, namely, the subgenus *Pika* to which the Mongolian *O. hyperborea mantchurica* belongs. The presence of this northern group on both sides of Bering Strait indicates again a close affinity between the living species of the two areas.

Among the hoofed mammals, the genus *Sus*, wild swine, is wholly unrepresented in North America, but it is mainly a group of the warmer parts of Asia and Europe, ranging northward to Mongolia and the Baikal region, but more abundant to the southward. The Musk Deer, which ranges northeastward into eastern Siberia, might have been expected to appear in western North America, while the Roe Deer, now common in southern Siberia, might also have been looked for, but both are unrepresented in the New World. On the other hand, the Red Deer and the Elk are both represented on the American side by near relatives, the Wapiti and the Moose.

The Wild Horse (*Equus przewalskii*), of extreme western Mongolia, as well as the Bactrian Camel, while no longer represented in the North American continent by related forms, were probably immigrants in early Pleistocene from that area, where both groups went through most of their evolutionary history. Remains of both genera are known from deposits of the Ice Age in Alaska.

These close relatives on both sides of Bering Strait indicate, then, a

former continuity of range by way of a land bridge between the two continents, of so comparatively recent a date that in most cases, at least, no great differentiation has taken place between the representative forms of the two areas.

A comparison of the mammals of northern China with those of corresponding latitudes of North America shows greater differences between related groups, indicative probably of an earlier land connection with a still warmer climate at higher latitudes, so that it was possible for their ancestors to range farther north and so avail themselves of the opportunity thus afforded to cross in either direction. This older connection was perhaps in the Pliocene, when, as shown by fossil remains, such trees as the bald cypress (*Taxodium*), the tulip tree (*Liriodendron*), honey locust (*Gleditschia*), sweet gum (*Liquidambar*) and others now found in southeastern United States were present also in western Europe and doubtless across the intervening area, for they also persist at present in southern China. In this connection, too, it is interesting to recall that the ginkgo tree, now confined to eastern Asia, has lately been found fossil in the late Tertiary of the State of Washington.

Among the Insectivora of North China and North America, few similarities appear. No hedgehogs survive in North America, although there is evidence that they may have occurred in early Tertiary; the genus *Crocidura* is also quite lacking, although represented by a few species in eastern China and Korea. A further contrast is the apparent absence of the genus *Sorex*, a diversified group in North America, and represented in the Mongolian forest and Siberia. Of moles, the genus *Scaptochirus* of North China has no close relative in America, but *Scapanulus*, found in the highlands of Shensi, Kansu, and Szechwan, is believed to be not distantly related to Brewer's Mole, *Parascalops*, of eastern North America, so that the wide gap now separating them is doubtless of long standing. A somewhat parallel case is that of the Eastern Chipmunk (*Tamias striatus*), of the eastern part of North America, now generically different from *Eutamias*, its close ally in eastern Asia and western North America. The mole (*Scaptonyx*), of the western Chinese highlands, is related rather closely to *Neurotrichus* of the American northwest coast. Among the rodents, the squirrel group of eastern and northern China shows little similarity to the North American members. The large flying squirrels are unrepresented in the latter continent; the genera *Callosciurus*, *Rupestes*, *Dremomys*, and *Sciurotamias* are also wholly confined to eastern Asia, the three last almost wholly to China. An interesting contrast is seen in the cricetines, for, whereas in North America the common white-footed mouse (*Peromyscus*) is widespread and in part a forest animal, with long tail, its closest allies in North China and Mongolia are all ground-living or burrowing forms with tails shortened or in some species reduced to a mere stump. Thus the genus *Cricetulus* is widespread over open country and invades the desert,

while *Phodopus* is a typically desert-living genus, with pallid coloring and the soles of the feet provided with pads of hair for progress on sand in which it burrows. The niche occupied by *Peromyscus* in the New World is taken by the wood mouse (*Apodemus*), a murine, which may in part explain the absence of a forest-living cricetine. The latter genus is confined to the Old World like the rest of the Muridæ, including *Mus*, *Rattus* and related genera, most of them warm-climate types. Thus the genus *Rattus* is chiefly tropical and south temperate in distribution with only two or three species that reach north temperate latitudes under natural conditions. No relatives of the abundant pocket gophers (*Thomomys*) of western North America are found in Asia, but their niche is occupied in northern China and parts of northern Mongolia by the arvicoline genus *Myospalax* of similar subterranean habits, while gerbils and jerboas (*Meriones*, *Rhombomys*, *Allactaga*, *Dipus*, etc.) fill the ecological niches taken in the New World by leaping desert species of *Dipodomys*. Of special interest is the case of the jumping mouse (*Zapus*), known from the Szechwan highlands of China, but so closely related to the American *Zapus* that it is at most but subgenerically different. This again may be a remnant of a wider distribution that took place possibly in Pliocene times, for at present it is unknown from other intermediate areas. The tree porcupines of America, on the other hand, are unrepresented in the Old World, though two genera of ground porcupines occur in China. The distribution of the "goat-antelopes" at present centers in southeastern Asia, with three genera—*Nœmorhedus*, *Capricornis*, and *Budorcas*—found in China. These are doubtless to be looked upon as survivals of primitive members of the Bovidæ, but although the first-named reaches the southern borders of Siberia in Amurland, none appears in North America, although the Rocky Mountain Goat (*Oreamnos*) is doubtless closely related. The musk-ox, probably also to be regarded as a member of this group, was nevertheless found in northern Asia in the Pleistocene, though now confined to arctic America and Greenland.

In general it may then be said that, while the mammals of northern Mongolia of the forest zone correspond in many cases to their close relatives of northern distribution in the New World, those of more southern latitudes, in northern and western China, are either unrepresented or their counterparts are much more distantly related. The obvious conclusion is that the former group owes its similarity to a more recent continuity of land area, while the latter group has been separated for a far longer period, allowing time for evolutionary changes in some types and the extinction or increase in others, with a resulting lack of similarity at the present time.

SECTION II

SYSTEMATIC ACCOUNT OF THE MAMMALS OF CHINA AND MONGOLIA

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SYSTEMATIC ACCOUNT OF THE MAMMALS OF CHINA AND MONGOLIA

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CHAPTER IV

ORDER INSECTIVORA

INSECTIVORES

THE Order Insectivora stands nearest among living mammalian groups to the stem from which the placental mammals have arisen. Its members are of small or even minute size; their reproductive system is of a generalized type, their teeth are nearly or quite of the full number (eleven in each jaw above and below) characteristic of placentals, and the molars are similar in structure to those of the carnivorous marsupials, which in sundry other respects, as in the formation of the brain and the presence of a distinct perforation (the entepicondylar foramen) at the inner side of the condyle of the humerus, they resemble. As a whole the Insectivora tend to have a tubular snout and a forceps-like action of the jaws, which results usually in an enlargement of the anterior incisors at the expense of the canines, and the arrangement of the incisors in lengthwise instead of transverse rows. The canines may be so reduced as to have disappeared altogether in some forms, although in a few, as the hedgehogs, they are well developed and may have double roots. Their food is chiefly of an animal nature, in which insects form a large part. The group falls readily into two divisions, by some regarded as almost the equivalent of separate orders, namely, a more primitive, the Menotyphla, in which the pubic symphysis is long, the postorbital process well indicated or even forming a complete ring about the eye, and the Lipotyphla, in which the pubic bones are barely or not at all in contact and the postorbital processes undeveloped. The two groups differ in many other minute but significant details of structure, as admirably set forth by Gregory (1910). The Menotyphla are represented by two living families, the Tupaiidæ or tree shrews, confined to southeastern Asia and of arboreal habits, and the Macroscelididæ or elephant shrews found in Africa mostly south of the Sahara. The former is represented in China by a single species. The Lipotyphla, which include the moles, shrews, and hedgehogs, on the other hand, are very well represented in eastern Asia, and include a few primitive forms, as *Uropsilus*, which show the steps in the origin of the mole-like from the shrew-like types. Three families of

this group are found in China and Mongolia, representing respectively, the hedgehogs and their allies, the moles, and the shrews.

KEY TO THE FAMILIES OF CHINESE AND MONGOLIAN INSECTIVORA

A. Form squirrel-like, tail well-haired and distichous; skull with orbit completely encircled by a bony ring ..... Tupaiidæ

B. Form not squirrel-like, tail close-haired, orbit not encircled by a bony ring.

a. Crowns of upper molars nearly square in outline, consisting of four subequal cusps, with a small central cusp ..... Erinaceidæ

b. Crowns of upper molars without a fifth central cusp.

a′. Zygomatic arch complete, form usually fossorial ..... Talpidæ

b′. Zygomatic arch incomplete through loss of the jugal; form more or less "mouse-like" ..... Soricidæ

Family TUPAIIDÆ

TREE SHREWS

Tree Shrews are squirrel-like in appearance and like squirrels are active by day. They are the most primitive of placental mammals, retaining arboreal habits with a generalized structure. Unlike squirrels, however, they have all five fingers of the hand and foot well developed and provided with a sharp claw; the muzzle is somewhat elongated, and the ears rather short. In the skull, the orbital ring is complete.

Genus **Tupaia** Raffles

Tupaia Raffles, Trans. Linn. Soc. London, vol. 13, p. 256, 1821.

In his review of the tree shrews, Lyon (1913) restricts *Tupaia* to those species in which the tail is well haired throughout, and distichous, the snout not especially elongated, the naked area on top of the nose cut squarely across instead of being slightly prolonged backward in the midline, the lower lobe of the ear smaller than the upper portion, and scantily haired. The tooth formula consists of: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{3}{3}$ = 38. The upper incisors are slightly enlarged, the lower narrow and proclivous, the canine above smaller than the incisors. The upper molars show very well the primitive pattern of cusps, with the W-shaped commissures. The genus is tropical and subtropical in distribution, confined to southeastern Asia, including the neighboring large islands. A single species reaches the southern borders of China and the island of Hainan, and is divisible into three rather poorly marked forms in this wide area. The type species of the genus is *T. ferruginea* Raffles (= *T. glis ferruginea*) of Sumatra.

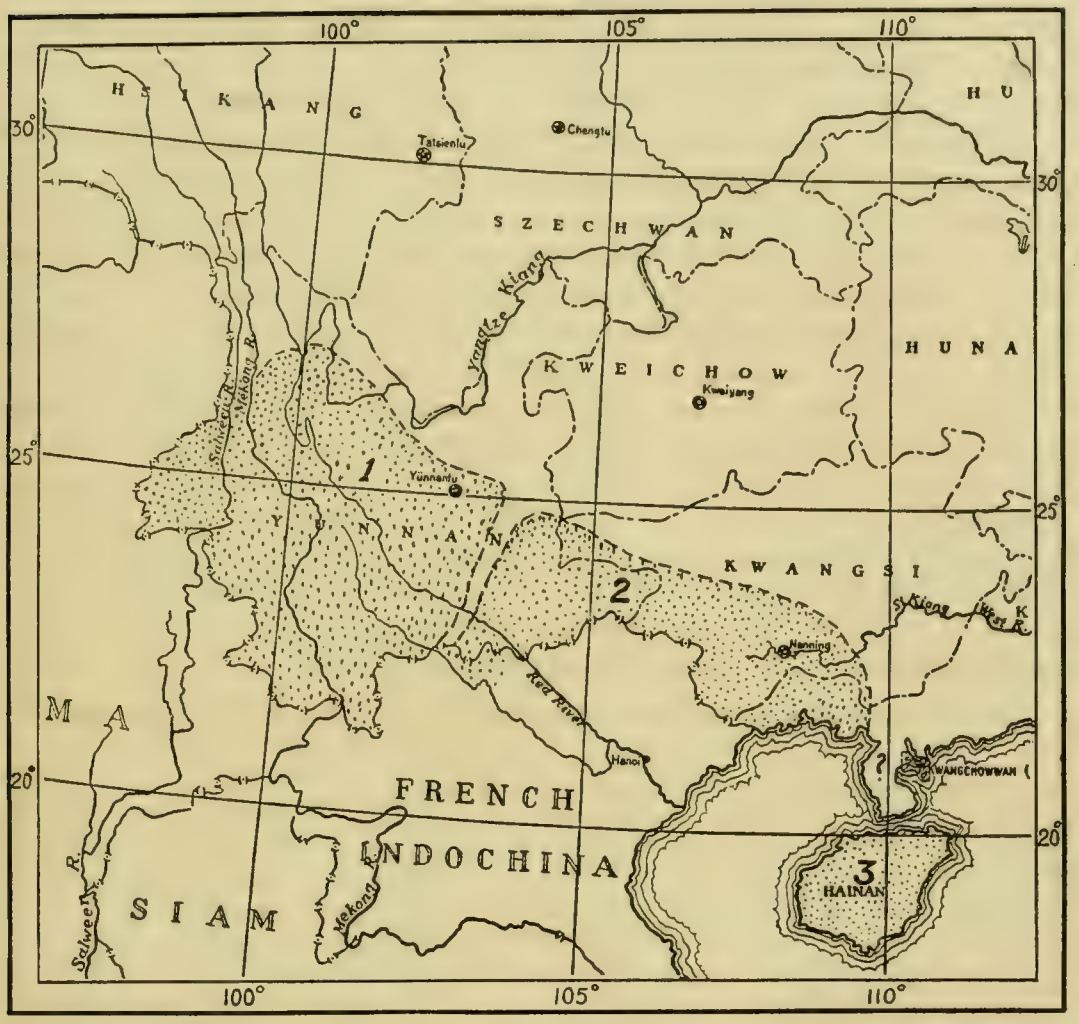

FIG. 1. Distribution Map.
Tupaia

1. *T. belangeri chinensis*
2. *T. belangeri yunalis*
3. *T. belangeri modesta*

KEY TO CHINESE RACES OF *Tupaia belangeri*

A. Light shoulder stripe evident.
   a. General tint above greenish..... *T. belangeri chinensis*
   b. General tint brownish..... *T. belangeri yunalis*
B. Shoulder stripe obsolete, general tint above grayer..... *T. belangeri modesta*

1. **Tupaia belangeri chinensis** J. Anderson

Tupaia chinensis J. Anderson, Anat. and Zool. Researches Western Yunnan, p. 129, pl. 7, figs. 8, 9, 1879.
Tupaia belangeri chinensis Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 13, p. 243, 1914; *ibid.*, vol. 14, p. 472, 1914.

Type specimens:—Anderson mentions two individuals procured by him upon which he founded his description: No. 204a, from Ponsee, Burma, in

alcohol, and No. 204b and c, the skin and skull of an adult from Muangla, Yunnan (Cat. Mammals Indian Mus., Calcutta, pt. 1, p. 155, 1881). According to Dr. Lyon, these are probably still in the Indian Museum.

Description:—General color above, from snout to tail, including the backs of hands and feet, an olive gray, very slightly darker in the middle region of the back where the black hairs are more numerous. The individual hairs are of two kinds: the shorter, with slaty bases and the terminal part pale greenish yellow or with a black ring dividing the greenish-yellow portion; and slightly longer, stouter hairs chiefly black, with or without a minute tip of greenish yellow. At the side of the neck a short, ill-defined pale streak extends back from the ear, where the terminal yellowish portion of the hairs is slightly paler and more extensive. The tail is like the back above, becoming slightly darker toward the tip; on its lower surface, the shaft is clothed with short appressed hairs colored like the rest of the tail in the apical third, but paler ochraceous buff basally. The entire under side from chin to vent, and the lower sides of the limbs, are pale ochraceous buff, the hairs with slaty bases except on the midline of the chest, the inguinal region, the interramal area, and arms. Ears similar to the back, but very thinly clad with short hair.

Measurements:—Collectors' measurements of two races are as follows:

T. belangeri chinensis

No.	Total length	Tail	Hind foot	Ear	Sex
84929	358	175	44	16	♂
84935	338	178	42	16	♂
84937	358	186	42	14	♂
84938	318	174	42	14	♂
84940	356	183	42	17	♂
84928	340	170	43	16	♀
84930	335	155	44	16	♀
84931	320	170	40	17	♀
84934	347	163	45	15	♀
84936	344	172	42	16	♀

T. belangeri modesta

No.	Head and body	Tail	Hind foot	Ear	Sex
59828	185	159	43	16	♂
59832	180	150	44	15	♂
59836	180	149	42	11	♂
59838	185	150	45	10	♂
59840	189	150	46	13	♂
59829	185	159	43	16	♀
59837	180	144	40	14	♀
59839	185	165	45	17	♀
59844	175	160	45	10	♀
59850	195	155	44	—	♀

CRANIAL MEASUREMENTS OF *TUPAIA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
				T. belangeri chinensis					
44280	46.7	41.3	24.2	23.5	16.7	15.9	23.7	22.9	Yunnan
44290	48.5	43.7	27.6	23.7	17.6	15.6	27.4	23.5	Yunnan
44293	47.2	41.6	24.4	24.5	17.5	15.5	24.6	23.0	Yunnan
84936	46.7	40.6	24.7	23.3	17.2	15.9	24.2	21.6	Yunnan
84929	48.6	42.2	25.6	24.6	17.7	14.6	24.2	22.0	Yunnan
84932	44.3	36.1	22.4	22.5	16.9	15.0	22.6	21.6	Yunnan
84934	47.4	41.7	25.1	24.7	18.2	16.0	25.1	23.5	Yunnan
84940	47.7	42.4	25.3	25.6	19.1	15.6	24.4	22.4	Yunnan
				T. belangeri yunalis					
13685 MCZ	48.2	42.5	26.0	25.2	19.4	16.6	25.7	24.5	Yunnan
13686 MCZ	45.3	40.5	23.7	23.9	17.0	15.8	23.6	22.5	Yunnan
13687 MCZ	45.5	40.7	23.6	23.4	18.5	15.5	24.1	22.2	Yunnan
				T. belangeri modesta					
52829	48.8	42.7	25.8	23.8	18.0	16.6	25.7	24.5	Hainan
59843	49.0	43.9	27.0	25.2	18.6	16.0	26.5	24.9	Hainan
59848	48.6	42.2	26.0	24.5	17.9	16.8	25.7	23.7	Hainan

Occurrence and Habits:—This tree shrew is characterized by its rather uniform olivaceous-gray color above, and as indicated by Lyon and later confirmed by Thomas (1914, p. 243), is a slightly differentiated race of *T. belangeri* of southern Burma, differing in its almost complete lack of ferruginous coloring on the back. True *T. b. chinensis* occurs in the North Shan States and across the southwestern part of Yunnan. A large series collected by Dr. R. C. Andrews and Mr. Edmund Heller, as well as others collected for the British Museum and the U. S. National Museum, indicates that it has a wide altitudinal distribution, from the lower levels as at Namting River on the Burma border, up to 9,000 or 10,000 feet on the Likiang Range and the mountains to the east. Others are from the Mekong River and about Tali Lake, Yunnanfu, and Yunnanyi. Specimens from the last three localities show intergradation with *T. b. yunalis* in the very slightly warmer tone of the back. It does not extend much farther north than the Likiang Range.

Little seems to be recorded concerning the habits of this species in China. It is in part tree-living, but apparently also spends much time on the ground. Anderson (1879) notes that the first one he saw on his Yunnan Expedition was in a grassy clearing close to patches of fruit, and that he at first mistook it for a squirrel. The stomach of one collected by Heller on the Mekong River contained seeds and leaves, indicating a partially vegetable diet, although insects and various other forms of animal life doubtless constitute its chief food.

Specimens examined:—The following thirty-seven:

Yunnan: Chiho, twenty miles south of Likiang, 2; Fengyang, 1; Hainkai, 1; Hsiohsien, 1; Likiang, 7; Mekong River, 3; Makaihsien, 2; Namting River, Burma border, 1; Peitai, 1; Mucheng, 1; Tali Lake and vicinity, 3; Wutinghsien, 1; Shihku, Yangtze River, 1; Yunnanfu, 1; one hundred and sixty miles west, 1; Yunnanyi, 5; Kaochiao, 6.

2. **Tupaia belangeri yunalis** Thomas

Tupaia belangeri yunalis Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 13, p. 244, 1914.
Tupaiia ferruginea Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 2, 1930.

Type specimen:—A skin and skull, No. 12.7.25.45, British Museum, one of seven collected by Orii, July 10, 1910, at Mengtsz, Yunnan.

Description:—Similar to *T. b. chinensis*, but the upper parts darker and of a much warmer tone, due to the more ochraceous subterminal rings of the particolored hairs, as well as to the more abundant black hairs which in some specimens darken the rump more than the back. The shoulder stripe is less conspicuous, shorter, and a nearly clear ochraceous, not so pale as in *chinensis*.

Measurements:—See table under *T. b. chinensis*, page 33.

Occurrence and Habits:—In southeastern Yunnan the tree shrew of the *T. belangeri* type becomes much less pale than in the western parts of the province, the greenish tone is warmer, the back darker, and the color a decided ochraceous. Thomas, who first recognized this difference, had specimens only from the extreme southern border, at Mengtsz, the type locality, whence also the Museum of Comparative Zoölogy has one specimen obtained by the same collector. Undoubtedly this form extends eastward along the extreme southern border of China for an undetermined distance, for Shih (1930, p. 2) records specimens secured by a Chinese expedition from Sun Yatsen University, Canton, in the Yao Shan area of Kwangsi, at Loshiang and Chinsiu. He observes that they are more ferruginous above than the Hainan tree shrew. There seems to be no record of the tree shrew in extreme southern Kwangtung, though its occurrence in Hainan implies its presence there; nor did Swinhoe learn of it near Amoy.

Specimens examined:—Three, namely: 2 from Mengtsz, Yunnan, and 1 from Tongking (M.C.Z.).

3. **Tupaia belangeri modesta** J. A. Allen

Tupaia modesta J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 481, 1906.
Tupaia belangeri modesta A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 5, 1929.

Type specimen:—An adult male, skin and skull, No. 26654, American Museum of Natural History, from Leimuimon, island of Hainan, January 5, 1903.

Description:—Upper surface of body and tail an even and finely ticked mixture of the usual black hairs and particolored hairs with subterminal ochraceous ring; muzzle and shoulders slightly grayer than in *T. b. yunalis*. Under side of chin, throat, and arms buffy white to the roots of the hairs, this color continued to the central area of the belly and inguinal region, where, however, the hairs are slaty-based. Shoulder stripe obsolete, at most a barely indicated area where the pale tips of the hairs are unmixed with black; in some immature individuals it is better marked. The pelage of December specimens is shorter and less full than in winter skins of *T. b. chinensis* from the Yunnan highlands.

Measurements:—See tables on pages 32 and 33.

Occurrence and Habits:—Notwithstanding the statement of its describer, that this "does not appear to be closely related to any of the previously described forms," it is really very close indeed to *yunalis*, differing chiefly in a slightly grayer tinge to the muzzle and shoulders, an average character only. From the race *chinensis* of western Yunnan, it is at once separated by its much more brownish hue, lacking the peculiar greenish tint of the latter. The shoulder stripe may be hardly perceptible, but in some immature specimens it is clearly present.

Swinhoe was the first naturalist to list the mammals of Hainan, but he evidently had no knowledge of the tree shrew of the island. It is, however, fairly common in suitable places. Dr. J. A. Allen (1906, p. 481), in recording it for the first time and publishing the original description, had seven specimens, five from Leimuimon in the mountains of central Hainan (the type locality), one from Utoshi, and one from Hoihow on the northern coast. He notes that there is a certain amount of individual variation in color, the youngest of the series having the throat more richly colored, tawny ochraceous. A. B. Howell (1929) mentions a specimen in the U. S. National Museum from Kachek, but otherwise there seem to be no other records of definite localities. Mr. Clifford H. Pope, who was successful in obtaining the large series noted below, from Nodoa and Namfong, 1922 and 1923, contributes the following interesting notes. "This little animal is of general distribution on the island, but nowhere occurs in great numbers. We first secured it in trapping—two of them caught in a thicket of high grass, small trees, and bushes. Later several more were caught, but never more than one or two at a time or in the same place in spite of dozens of traps set out. Those we caught came to bait of peanut butter. The fact that the traps were nearly always set in late afternoon and taken up early the following morning may in part account for our failure to take more, for they seem to be largely active by day. One was shot in the Mission compound, at Nodoa, near if not actually in one of the foreigners' houses and I was told that on a previous occasion one had been found in the

same house. Another appeared to live under the porch of one of the houses. I used to see it hopping about in the grass by the side of the house in the middle of the forenoon but if approached, it would run under the house and hide. They seem to be largely terrestrial, as well as diurnal, for my Chinese hunter shot a few, all in broad daylight. On occasion they may utter a shrill cry."

Specimens examined:—In all, twenty-eight, as follows: Hainan: Nodoa, 23; Namfong, 5.

Family ERINACEIDÆ

HEDGEHOGS AND THEIR ALLIES

This family includes the hedgehogs and their relatives. They differ in many details of structure from the tree shrews, and constitute with the other living insectivores (except the latter and the elephant shrews) the suborder Lipotyphla. The pubic symphysis is very short, hardly more than a contact of the pubic bones. There is no complete bony ring surrounding the orbit as in tree shrews, but instead the postorbital processes are reduced to a mere point (in *Neotetracus*) or quite lacking. There is a marked constriction of the skull behind the orbits, and the zygomatic arch is slender. The snout is not especially elongate, and the palate retains the primitive trait of having its posterior border bounded by a raised transverse ridge. The first upper incisor is the longest, the canine is somewhat reduced in size, and usually two-rooted. The first premolar is large, its main outer cusp extending well below the level of the molars. The latter are of characteristic form, with the postero-internal cusp (hypocone) so enlarged as to give the crown of the tooth a nearly square outline. There are four blunt main cusps and a smaller fifth cusp in the center of the crown. The five digits are usually retained on each foot, the radius and ulna are free, but the tibia and fibula are fused together.

Two subfamilies are recognized: the Gymnurinæ, including the more primitive members with nearly normal form, spineless coat and a longer or shorter tail; and the Erinaceinæ or Old World hedgehogs, with shortened skulls, compact, nearly tailless bodies, and a protective spiny coat.

Key to the Genera of Chinese and Mongolian Erinaceidæ

A. Form rat- or mouse-like, fur normal, tail slender.
   a. Tail about half the length of head and body..... *Neotetracus*
   b. Tail about as long as the hind foot..... *Hylomys*

B. Form stout, back with a spiny coat, tail a mere stump.
   a. Spines of the crown with a median parting, ears long, the postglenoid processes of the skull as large as the mastoid processes and hollowed internally *Hemiechinus*
   b. Spines of the crown without a median parting, ears shorter..... *Erinaceus*

Genus **Hylomys** S. Müller

Hylomys S. Müller, in Temminck, Verhand. Natuurl. Gesch. Nederl. Bezitt., vol. 1, Zoogd. Indisch. Archip., p. 50, 1839.

In external form the body is slender, mouse-like, with a tapering snout and well-developed ears, but the tail is very short, about the length of the hind foot, slender and thinly haired. The hands and feet retain each five digits but the first and fifth are so short as barely to reach the bases of the three middle toes. The skull has the full placental tooth formula: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{3}{3}$ = 44. The anterior incisor is longest, the two others much smaller and shorter; the canine slightly larger and triangular in profile, with two roots; the three first premolars are all small, two-rooted, and hardly half as high as the fourth which is large with a prominent outer cusp, exceeding the molars in height. The latter are squarish in crown view, the two anterior of nearly equal size, the third much smaller with its outer posterior cusp much reduced.

These small ground-living insectivores are known from the more tropical parts of the Malay Peninsula and the larger East Indian Islands. One of the forms barely reaches the southwestern border of China in Yunnan. The type species of the genus is *Hylomys suillus* Müller and Schlegel, of Java.

4. **Hylomys suillus peguensis** Blyth

Hylomys peguensis Blyth, Journ. Asiatic Soc. Bengal, vol. 28, p. 294, 1859.

Type specimens:—The species appears to have been based upon two individuals from Pegu, Tenasserim, obtained by Blyth and probably still in the Indian Museum at Calcutta, where Anderson seems to have examined them and removed the skull of one previous to 1872.

Description:—Upper surface of the head, body, and limbs a very uniform pale olive yellow and black mixed, giving a somewhat similar color to that of *Tupaia b. chinensis*. Individual hairs are either black throughout or slaty at the base with a short, pale-ochraceous terminal or subterminal band. The sides of the face about and below the eye are slightly clearer and brighter ochraceous, and the rump is a very little brighter than the middle of the back, but otherwise the coloring is very uniform. A certain sheen is imparted to the pelage by the burnished appearance of many of the longer hairs with their yellowish tips. The ears, feet, and tail are nearly naked, with a scattering of minute short hairs, those on the hind feet and tail brownish. Below, the coloring of the upper surface merges rather suddenly with that of the under side, which is grayish white, with a very faint creamy tint on the lower throat and chest, the bases of the hairs slaty gray. The lower side of the metatarsus is clad with short stiff hair.

The skull and skeleton have been very carefully described and figured by Anderson (1874) from a specimen he picked up on the Yunnan border near

Ponsee, Burma. In form the skull differs from that of *Tupaia* in a slightly more elongate snout, less rounded, more flattened brain case, and the reduction of the bony ring about the eye to a mere projecting point on the frontal behind the eye. It is very light and delicate, and the zygomatic arch is thin and slender, especially at the posterior part. The palatal bones in the specimen examined contain several minute vacuities, and the palate itself ends in a transverse ridge with a short median projection. The palate is somewhat arched, the tympanic bullæ incomplete.

The teeth are of the full number found in placentals, 44. The anterior incisor is largest, the second about half its height, and the third about half the height of the second. The canine and fourth premolar are again larger, the former in the upper jaw double-rooted, the latter with its outer anterior cusp (paracone) much enlarged, while between them are three other much smaller premolars of subequal size and nearly half the height of the two larger teeth. The molars are three above and below, the first two upper ones squarish in outline, and consisting of four main cusps with a fifth smaller central cusp. The third molar has the metacone reduced, so that the outline is nearly triangular.

As an anomaly, No. 44274 (now 20687 M.C.Z.) has but two upper incisors on the right side, the small third incisor having been lost.

Measurements:—The six specimens were measured by the collector as follows:

No.	Head and body	Tail	Hind foot	Ear	Sex
44112	115	19	25	17.0	♂
44273	112	20	23	16.5	♂
44275	115	23	24	17.0	♂
44113	110	22	23	17.0	♀
44272	105	24	23	16.0	♀
44274	125	22	23	16.5	♀

CRANIAL MEASUREMENTS OF *HYLOMYS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
44272	31.7	28.5	17.3	——	13.3	10.1	17.0	15.5	Yunnan
44274	32.9	30.0	17.5	(16.5)	13.8	10.7	16.3	15.6	Yunnan
44275	32.4	29.8	17.0	16.5	12.7	10.4	16.5	15.6	Yunnan

Occurrence and Habits:—Little is known of the habits of this species, but Anderson supposed that it was, in part at least, tree-living, although its elongate feet and shortened tail would rather indicate ground-living habits. The genus was first discovered in Java, but later on the mainland of the Malay Peninsula in a nearly identical form. Blyth in 1859 described as *Hylomys peguensis* the very similar animal from Pegu, Tenasserim, and Anderson (1874, 1879) during

his expedition to the borders of western Yunnan, picked up dead on the path at Ponsee, Upper Burma, a specimen that he referred to the same species and later used as the basis of his careful account of the skeleton with figures. The occurrence of *Hylomys* in Borneo was recorded by Thomas, who in 1888 named this island form *H. suillus dorsalis*. In recent years, the form on Sumatra has been distinguished as *Hylomys parvus* by Robinson and Kloss, and the latter author gave the name *Hylomys siamensis* to a specimen from Hinlap, eastern Siam, on the ground of paler, more buffy coloration and narrower nasals, while in 1925 Thomas named *H. suillus microtinus*, a light-brown race from Thai-Nien, Tongking. In the lack of specimens for more minute comparison, I have referred to *H. suillus peguensis* the series obtained in western Yunnan by the American Museum Asiatic Expeditions, following Anderson, who had seen the original specimens. It is not at all impossible, however, that they will eventually be found to constitute a local race.

Although Anderson (1879, p. 138) long ago recorded this animal from the very border of Yunnan, it remained for Dr. Andrews's expedition actually to secure it in China. He and Edmund Heller discovered it at only one place, on the Namting River at the Burma border, at an elevation of 1,700 feet. In late February, 1917, six specimens were trapped, one of which contained two embryos. There are apparently no other records, and the species seems thus to be another of those subtropical mammals whose range just reaches the southern edge of China.

Specimens examined:—Six, from Yunnan, Namting River, Burma border.

Genus **Neotetracus** Trouessart

Neotetracus Trouessart, Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 389, 1909.

Externally the insectivores of this genus resemble *Hylomys* except that the tail is well developed, about half the length of head and body, thinly clad with minute hairs. The genus was so named by Trouessart in the belief that its tooth structure resembles that of the supposed fossil hedgehog (*Tetracus*) of the Eocene of France. It is, however, as Thomas (1911d, p. 162) has pointed out, "strictly a member of the Gymnurinæ," and only distantly related to the hedgehogs. It is a near relative of *Hylomys*, with which it agrees in the formula of both its milk and permanent dentitions, except in the absence of the minute second premolar, p2, showing, therefore, a more progressive state, so that the tooth formula is: i. $\frac{2}{3}$ c. $\frac{1}{1}$ pm. $\frac{3}{3}$ m. $\frac{3}{3}=40$ in the adult, while in the milk dentition there are only two upper incisors. On the other hand, its tail has undergone less reduction, and the thumb is very slightly longer.

The skull resembles that of *Hylomys*, but the rostrum is slightly shortened, correlated with the loss of one premolar, and there is a slightly more definite postorbital process. The palatal bones have better-developed slit-like vacu-

ities, one in each, with a few irregular pores behind them. The upper first incisors are a trifle longer and more vertically placed.

The type and only known species of the genus is the following.

5. **Neotetracus sinensis** Trouessart

Neotetracus sinensis Trouessart, Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 389, 1909.

Type specimens:—No one of the original series of seven skins and skulls from Tatsienlu, Szechwan, is designated as the type, nor are their numbers or location given. All are therefore to be regarded as cotypes, and are presumably still in the Muséum d'Histoire Naturelle in Paris.

Description:—General external appearance much as in *Hylomys suillus peguensis* except that the tail is much longer, slender and mouse-like, and the mystacial bristles somewhat longer. The upper surfaces of head and body are of a general olive-brown tone, and the under parts are gray with a very light buffy wash. The individual hairs of the back and sides are of two sorts: some entirely black; others with blackish bases, then a band of light ochraceous and a fine black tip. On the sides the latter hairs are slightly more abundant and their ochraceous rings broader and polished, giving a lighter and somewhat glinting appearance. The sides of the head and neck have a richer tint through the more rusty color of the light band. The ears and upper side of the tail are dusky, dark brown, covered thinly with blackish-brown hairs visible with a lens only. The entire under side is pale gray, the hairs with slaty bases, the whole with a faint suffusion of buffy. The backs of the feet are thinly covered with pale hairs, among which on the metatarsal area are a few dark-brown hairs.

The skull, while much resembling that of *Hylomys*, differs in many details, as noted above. Thus, in addition to the reduction of the premolars, from four above and below, to three in each jaw by the loss of one of the minute teeth, the canine is slightly smaller; the first upper incisors are actually larger and more pointed. The rostrum is relatively shorter through the reduction of the front end of the maxillaries and of the nasals; the palatal bones are more fenestrated, and the postorbital process is more developed and distinctly projects as a sharp spicular point.

Measurements:—The following measurements were made in the field by the collector:

No.	Head and body	Tail	Hind foot	Ear	Sex
44238	105	64	26.0	17	♂
44252	122	62	25.5	18	♂
44258	115	60	24.0	17	♂
44269	125	70	26.0	18	♂
44266	110	64	24.5	17	♀

CRANIAL MEASUREMENTS OF *NEOTETRACUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
44238	30.8	27.4	16.8	17.0	12.0	10.0	15.7	15.0	Yunnan
44239	29.9	27.4	16.1	16.5	12.4	9.5	14.7	14.0	Yunnan
44240	30.3	27.2	16.3	16.1	12.5	9.5	14.6	14.0	Yunnan
44249	29.3	26.0	15.6	15.6	12.4	9.4	14.4	14.0	Yunnan
44252	32.0	29.0	17.8	18.0	13.0	10.0	16.0	15.0	Yunnan
44254	28.5	26.2	15.4	15.7	12.1	9.3	14.1	13.7	Yunnan
44255	29.8	27.4	16.3	17.0	12.5	9.8	15.0	14.4	Yunnan
44256	30.8	27.7	16.5	17.2	12.6	10.0	15.6	14.6	Yunnan
44258	31.0	28.0	16.2	17.0	12.0	9.7	15.3	14.6	Yunnan
44266	31.0	27.2	16.0	17.3	12.3	10.0	15.0	14.8	Yunnan
44267	32.3	30.0	18.3	18.0	12.6	9.6	16.4	15.4	Yunnan

Occurrence and Habits:—The discovery of this remarkable insectivore is due to the enlightened interest of Monseigneur Biet of the Catholic Mission at Tatsienlu, Hsikang, who sent a series of seven from that locality to Professor E. L. Trouessart at Paris. The latter in a brief account of the animal (Trouessart, 1909) announced his intention of giving later a more detailed description of its anatomy, but this has never appeared. The only other records for the species are those of Thomas (1911d, p. 162), who reports that the Duke of Bedford's Expedition under the leadership of Malcolm P. Anderson secured a male forty-five miles southwest of Yachow (east of Tatsienlu) and thirteen at Omei Shan (just south of the latter locality); while in Yunnan, Mr. F. Kingdon Ward obtained a specimen at Yangpi, 7,000 feet.

The American Museum Asiatic Expeditions found this a common species in parts of western Yunnan, and obtained series at Mucheng, on the Salween drainage (7,000 ft.), Homushu Pass (8,000 ft.), and at Taipingpu on the Shweli River, 7,000 ft. Evidently it has a somewhat restricted range at intermediate altitudes in the northern half of Yunnan and the southern half of Szechwan, with probably a slight extension eastward.

Anderson, who secured the series at Omei Shan, notes that they are found in damp forest away from water. The stomach contents of one consisted of "earthworms." The stomach of another collected by Andrews and Heller contained, on the contrary, "vegetable matter," indicating perhaps a mixed diet, for which the low-crowned molar teeth are well suited.

Anderson found four embryos in one and five in another (August 10) female; four were found also by Andrews and Heller in a female taken April 10 at Taipingpu. The mammæ are 2—2, or 8 in all (Thomas, 1911d).

Specimens examined:—In all, forty-four, as follows:

Yunnan: Mucheng, Salween drainage, 21; Homushu Pass, 8,000 feet, 17; Taipingpu, Shweli River, 7,000 feet, 6.

FIG. 2. Distribution Map.

Erinaceus

1. *E. europæus dealbatus*
2. *E. europæus miodon*

Hemiechinus

3. *H. dauuricus dauuricus*
4. *H. dauuricus alaschanicus*

Genus **Hemiechinus** Fitzinger

Hemiechinus Fitzinger, Sitzungsb. Kaiserl. Akad. Wiss., Wien, math.-nat. Classe, vol. 54, pt. 1, p. 565, 1866. *Ericius* Sundevall, Kongl. Vet.-Acad. Handlingar for 1841, Stockholm, pp. 223, 230-237, 1842. Lönnberg, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 620, 1922 (preoccupied by *Ericius* Tilesius, 1813, for a genus of fishes).

The hedgehogs of this genus differ from the typical members, of which *Erinaceus europæus* is an example, in having no median parting of the spines on the crown, while in the skull the postglenoid processes are as large as the mastoids and hollowed internally (Thomas, 1918, p. 193). The type species is *H. platyotis* of northeastern Africa, but in their main distribution they are characteristic of southeastern Europe and the desert region of central Asia. In this group the ears are more prominent than in the common European hedgehog, with which, however, it agrees in having five toes on both fore and hind feet, and differs from the African genus *Atelerix* with four toes only, on the hind foot. All the species are provided with a spiny armor, and if disturbed can roll themselves into a ball, presenting the spines in all directions.

The large heavy skull, with shortened rostrum, no postorbital processes, large palatal slits, and well-developed tympanic rings is in contrast to that of the Gymnurinæ. The dental formula is the same as in *Erinaceus*, namely: $i.\frac{3}{2}$ $c.\frac{1}{1}$ $pm.\frac{3}{2}$ $m.\frac{3}{3} = 36$. The first upper incisor is stout, terete, and quite twice as high as the second and third. The second upper incisor is smaller than the third and single-rooted, while the latter is two-rooted, as are also the canine and two anterior premolars. The outer anterior cusp of the last upper premolar is high and conspicuous. The two anterior molars are as typically in the family, squarish in outline, with four blunt cusps and a minute central one. The last upper molar, like that of *Erinaceus*, is reduced to a narrow crescent, but instead of having its long axis nearly in line with the outer border of m^2, it is instead nearly transverse. Both lower incisors, the canine and the first premolar are single-rooted; the second premolar is large and high with two roots, and two prominent cusps, of which the anterior in profile is slightly the shorter. The last lower molar lies on the inner side of the tooth row and is reduced to a small oval in crown view, with indications of two very short cusps at its posterior border.

Although several species of this group have been described from Mongolia and its borders, it seems unlikely that more than one species is really represented, with perhaps one subspecies, the value of which is still not very clear.

6. **Hemiechinus dauuricus dauuricus** (Sundevall)

Erinaceus dauuricus Sundevall, Kongl. Vet.-Acad. Handlingar for 1841, Stockholm, p. 237, 1842. Dauuria.
Erinaceus auritus Pallas, Zoographia Rosso-Asiat., vol. 1, p. 138, 1811; vol. 1, p. 138, 1831 ed.; not *Erinaceus auritus* Linnæus, 1758. Transbaikalia, Dauuria.
Erinaceus dauricus Wagner, Arch. f. Naturgesch., vol. 9, pt. 2, p. 27, 1843.
?Hemiechinus przewalskii Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1906, vol. 11, p. 181, 1907. "Nord China?"
Hemiechinus (?) *dauricus* Satunin, *ibid.*, p. 185.
?Ericius przewalskii Lönnberg, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 626, 1922.

Type specimen:—No type is specified. Sundevall's name is based directly on the description by Pallas of specimens of a hedgehog from Dauuria, Transbaikalia. Pallas, in his Zoographia, gives accounts of both the common European Hedgehog and the long-eared species, for the latter of which he uses Linnæus's name, *Erinaceus auritus*, to include all the Asiatic forms of this group, with a general range (op. cit., p. 138): "In australioribus Tatariæ magnæ atque Sibiriæ . . . usque ad Baicalem lacum frequens." He makes special mention (op. cit., p. 139) of the fact that those from the latter area are larger and paler: "In Daurico qui libr. rossicas 2⅜ ponderabat, longitudo a summo naso ad anum 9″. 7‴. aures 1″. 4‴. cauda 1″. 1‴. . . . Dauuricis in genere vellus subtus fuscescente-cinereum, vel subgryseum . . . Mongolis sunt in deliciis." When Sundevall (1842) published his synopsis of the hedgehogs, he stated that the Dauurian species was unknown to him by specimens, but on the basis of Pallas's brief diagnosis, gave it the name *Erinaceus dauuricus*. It may be questioned whether this hedgehog reaches the Transbaikalian district, for Radde (1862), who collected a series of hedgehogs there, in his account refers them to *E. europæus* and in his plate figures skulls of the Amur race of that species. Satunin, however, has examined his original set of five skins with fragmentary skulls and (1907a, p. 186) gives a brief account of them, reviving Sundevall's name.

Description:—The spines begin on a line slightly behind the anterior base of the ears and extend to the area just above the tail. The spines are dark brown at the extreme base, then dull whitish for nearly one half their length, with next a band of brownish black and a contrasting white tip; the coloring of the hair of the lower parts is very pale, varying somewhat, but apparently, from Satunin's account of the Dauurian specimens, the upper part of the head and the sides are pale brownish gray with faint rusty wash on back of snout and forehead. The chin, throat, and middle region of the belly are soiled white; the tail and the feet are chestnut brown, the latter mixed with gray. In some of the specimens the sides are brownish gray. Young individuals are said to lack the dark base of the spines. An immature specimen has the entire under side grayish brown with dark-brown feet. Ears covered with yellowish-white hairs on inner side and with pale brown on the outer.

Measurements:—No measurements are available except those of Pallas, which, converted into millimeters, are: head and body, 244; tail, 28; ear, 34.

Satunin gives the following skull measurements for one of Radde's specimens from Dauuria: tip of rostrum to infraorbital foramen, 15.5 mm.; length of nasal suture, 14; combined width of nasals, 4; zygomatic width, 36; least interorbital width, 13.9; width outside first molars, 22.5; width of rostrum at level of first incisor, 7; distance between antorbital foramina, 14.

CRANIAL MEASUREMENTS OF *HEMIECHINUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row, alveoli	Lower tooth row, alveoli	Locality
				H. dauuricus dauuricus					
(after Lönnberg)	56	51.5	31.5	36.5	29.3	24	28.7	——	Mongolia
				H. dauuricus alaschanicus					
20683 MCZ	47	45	25	28.6	24	19	24	19	Mongolia

Occurrence and Habits:—The range of the long-eared hedgehogs covers an enormous territory from southeastern Europe and Egypt to the eastern parts of Siberia. In all this area a number of species have been recognized, but it is not at all certain that they may not be geographic forms of one or two species. Thus the present animal may be merely a subspecies of *Hemiechinus auritus* of Europe, but until this can be definitely shown it may stand as distinct. The long-eared hedgehog of Dauuria evidently has a restricted range in southern Transbaikalia, where it was taken by Radde in the region about the Tarei Nor on the northeastern edge of the Gobi. No doubt it occurs locally across Mongolia, and from his account, either in grass land or more usually in the tree- and bush-grown parts, probably avoiding the open desert. Recently Lönnberg (1922) has recorded under the name *Ericius przewalskii* three hedgehogs from Mongolia, two taken by Professor J. G. Andersson at Bank Tsagan and Burtun Nor respectively, and a third from Tabool, received later from the same collector. These he regards as larger than the small pallid race, *Hemiechinus alaschanicus*, and refers to Satunin's species *Hemiechinus przewalskii* doubtfully. The latter was based on a specimen from an unknown locality, but labeled as from "?North China," collected by Przewalski in 1874, the year in which he procured the types of *H. albulus alaschanicus*. If it is not synonymous with the latter, the name is probably best regarded as a synonym of *H. dauuricus* until some trenchant character can be pointed out. Lönnberg admits that it is "hardly possible to tell" if it is really different. He gives the following measurements of two of his specimens:

	Total length	Tail	Hind foot (without claws)	Ear
——	210	25	41	24 (dry)
Tabool	266	31	43	33

The cranial measurements of Lönnberg's Tabool specimen are reproduced in the table on this page.

Specimens examined:—None.

7. **Hemiechinus dauuricus alaschanicus** Satunin

Hemiechinus albulus alaschanicus Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1906, vol. 11, p. 181, 1907.

Type specimens:—In his brief description, Satunin lists four specimens: No. 2020, male, from southern Gobi; 2018, 2019, 2021 from Alashan, all collected by Przewalski in 1874, and now in the Museum of the Academy of Sciences at Leningrad. Since no type is specified, all are cotypes.

Description:—Similar to *H. dauuricus* but paler, the sides and under parts usually pure white instead of washed with grayish brown, and the forehead a pale rusty brown; backs of the feet dusky brown, mixed with gray. The spiny covering consists of spines of the usual type in the species, but their long white tips give a very pale effect. There is a slight amount of individual variation in color; youngish examples are whiter, less creamy.

Measurements:—Hind foot, with claws, 35 mm., without claws, 30 mm. See table under preceding race for cranial measurements.

Occurrence and Habits:—Although described as a form of *H. "albulus,"* there can be no doubt that this is merely a pale desert race of the Dauurian hedgehog (*H. dauuricus*), from which it chiefly differs in the more pallid coloration, with white sides and under parts, lacking the brownish wash. Hedgehogs of this species doubtless occur locally throughout the Gobi, but were secured at only two places by the Central Asiatic Expeditions, namely at Tsagan Nor, where five adults were taken, and at Artsa Bogdo, where on July 18, 1925, a young one only 90 mm. long was found. Howell (1929) mentions four specimens in the U. S. National Museum, from northwest of Ningsia, which agree in characters with this form.

In his field notes concerning these hedgehogs, Dr. R. C. Andrews writes that in a river bottom at Tsagan Nor, one was captured alive in a trap, uninjured, and after two days became very tame, allowing itself to be handled freely. It ate grasshoppers and beetles or any other insects voraciously, as well as raw meat, licking its mouth afterward. It drank water once or twice every day, taking a considerable quantity each time. It was possessed of great curiosity, and liked to poke about into corners, investigating carefully any new object. The skin of the back bearing the spines was very loose, except when the animal was frightened, when it stiffened, causing the quills to stand out at all angles. It walked very high on its legs, and *entirely* on the palms of its feet, holding the toes and nails high off the ground. In running it would go at an astonishing rate, and kept much closer to the ground. At Tsagan Nor the hedgehogs were attracted by some meat thrown into the grass near camp, and close to the water's edge. Three or four were caught, as well as

A tame Long-eared Hedgehog (*Hemiechinus dauuricus alaschanicus*) at Tsagan Nor, in the Gobi, about to fold up

The hay-pile of a Pallas's Mouse-hare (*Ochotona pallasii pallasii*) at Artsa Bogdo, in the Gobi

three young ones that came to traps baited with meat, so they must have been fairly abundant.

Specimens examined:—The following seven:

Mongolia: Tsagan Nor, 6; Artsa Bogdo, 1.

Genus **Erinaceus** Linnæus

Erinaceus Linnæus, Syst. Nat., ed. 10, vol. 1, p. 52, 1758.

The typical hedgehogs differ from the long-eared group chiefly in rather stouter build, with larger feet and stronger claws, in their shorter ears which do not exceed the adjacent spines, and in having the spines of the occipital region arranged in two clusters with a parting or naked strip between, not always apparent when the spines are spread.

The skull has a blunter and less tapering snout; the nasals are extremely narrow, tapering to a fine point behind, while the tip of the ascending process of the premaxillary is broad and ends bluntly instead of in a slender point. The post-glenoid process is less hollowed out behind than in the related group. The teeth are more specialized, in that all the incisors, the canine and the first premolar are usually single-rooted, although occasionally the canine may have a double root. The last molar above is much reduced and usually stands with its long axis in line with the outer cusps of the second molar, instead of nearly transverse to the tooth row. The tooth formula is as in *Hemiechinus*.

Probably two forms only are to be recognized from China, both here considered subspecies of the European animal.

8. **Erinaceus europæus dealbatus** Swinhoe

CHINESE HEDGEHOG

Erinaceus dealbatus Swinhoe, Proc. Zool. Soc. London, 1870, pp. 450, 621.
Erinaceus collaris Gray, Proc. Zool. Soc. London, 1861, p. 390 (part).
Erinaceus europæus dealbatus Barrett-Hamilton, Ann. Mag. Nat. Hist., ser. 7, vol. 5, p. 367, 1900.
Erinaceus kreyenbergi Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, pp. 135, 138, 1908. Shanghai Market.
Erinaceus tschifuensis Matschie, *ibid.*, p. 137. Chefoo, Shantung.
Erinaceus hanensis Matschie, *ibid.*, p. 138. Hankow, Hupeh.
Erinaceus chinensis Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1906, vol. 11, p. 173, 1907. Khingan, Tyntza-intza.
Erinaceus hughi Thomas, Abstract Proc. Zool. Soc. London, December 15, 1908, p. 44; Proc. Zool. Soc. London, for 1908, p. 966, 1909.

Type specimens:—Swinhoe specified no type specimen in his original description, but Barrett-Hamilton states (1900, p. 367) that it is No. 61.6.2.5, British Museum, from Peiping. The type of *E. kreyenbergi* was a specimen procured in the Shanghai Market, and is said to be in the Museum at Magde-

burg, Germany. In recording the specimen, Hilzheimer (1906, p. 184) states that the head was lacking, but Matschie (1908) shows that this is not the case, and he examined the skull with the skin. The type specimen of *E. tschifuensis* is a skin and skull, No. 4625 in the Berlin Museum, from Chefoo, Shantung, and that of *E. hanensis* a skin, number not recorded, in the same institution from Hankow, Hupeh. The type of *E. chinensis* is in the Zoological Museum of the Academy of Sciences at Leningrad. *E. hughi*, from Paochi, Shensi, is a rather dark example of *E. dealbatus*, lacking any conspicuous number of all-white spines.

Description:—Similar to the European hedgehog, *Erinaceus europæus*, but paler in color and somewhat smaller; spines on the head in two groups, one on each side of the occiput, with a narrow bare space between; feet large with prominent claws on all the toes. The spines are of two sorts, some all white or white with a minute brownish point, but the greater part whitish basally with a broad band of light brown, not sharply defined, then an equal one of white, succeeded by a minute brown tip, giving a general brownish gray, pepper-and-salt effect. The face, limbs, sides and lower parts are clothed with coarse hair, rather uniform in color, varying from pinkish buff (as in a specimen from Ichang) to whitish, with a light brown wash on hands and feet. There is, however, much individual variation in color. Thus of two taken by the Central Asiatic Expeditions, one (from Yochow) has rather few dark spines, so that the paler tint predominates, while the other (from Wuhu, Anhwei) has a preponderance of dark spines. Matschie describes the lower parts of a specimen bought in Shanghai as ochraceous.

The skull, while closely resembling that of the common European species in general form, is smaller on the average, and much slenderer. The premaxillaries, in contrast to the condition in *Hemiechinus*, are usually almost truncate vertically at their upper ends instead of attenuate. The nasals, as in *E. europæus*, vary individually from extremely narrow with a combined width of only 1 mm., to twice that width. The teeth, though smaller, are essentially like those of *E. europæus*, except that the third upper incisor seems slightly larger in proportion; the last upper molar is small and narrow as in the latter, but in some individuals stands more nearly transverse to the tooth row instead of at an angle of some 45° as it does in European specimens.

Measurements:—This eastern hedgehog seems to average smaller than full-grown European animals. The following dimensions were taken from fresh specimens by the collector:

No.	Head and body	Tail	Hind foot	Ear	Locality
8.2.8.1 BM	217	42	41	25.5	Shantung
8.2.8.2 BM	215	45	40	26.0	Shantung

CRANIAL MEASUREMENTS OF *ERINACEUS* FROM CHINA

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width outside molars	Upper tooth row	Lower tooth row	Locality
				E. europæus dealbatus					
25884 MCZ	52.8	49.2	30.0	32.0	19.0	21.0	27.3	26.0	Shantung
25885 MCZ	53.5	52.0	30.3	32.2	21.0	20.0	27.2	25.8	Shantung
4625 BERLIN	58.9	56.6	——	35.9	——	22.1	30.4	——	Shantung
8.2.8.1 BM	——	——	31.0	——	——	22.7	28.5	26.8	Shantung
LÖNNBERG	51.0	47.0	29.0	31.0	25.0	20.5	27.3	——	Hopei
7132 MCZ	49.5	46.5	28.0	30.0	17.6	20.0	27.0	26.6	Hupeh
56508 U. MICH.	56.6	53.7	32.4	34.1	27.9	20.5	28.1	25.7	Kiangsu
56509 U. MICH.	53.5	49.7	30.9	(30)	25.7	19.3	27.6	25.4	Kiangsu
				E. europæus miodon					
9.1.1.2 BM	54.6	50.1	28.5	33.1	26.0	21.1	26.5	23.9	Shensi
9.1.1.4 BM	53.2	48.6	28.5	32.0	25.6	20.5	26.0	24.5	Shensi
9.1.1.5 BM	53.7	49.5	29.3	33.2	25.7	21.6	27.5	25.5	Shensi
9.1.1.6 BM	50.9	47.1	27.0	30.8	26.0	20.3	26.0	24.6	Shensi
9.1.1.7 BM	49.3	44.7	27.0	28.7	24.3	20.5	26.3	24.6	Shensi
9.1.1.8 BM	51.9	47.0	27.4	32.0	25.0	20.6	25.7	23.4	Shensi
9.1.1.9 BM (type)	53.7	50.2	28.7	35.7	27.0	22.3	27.0	25.2	Shensi
9.1.1.10 BM	55.2	50.2	29.1	32.3	25.9	21.5	28.3	25.6	Shensi

Nomenclature:—After careful consideration of the various names applied to Chinese hedgehogs of this group, there seems to be little doubt that most of them are synonymous with *E. dealbatus*, based on variations that are really only individual. Thus Matschie (1908) describes as *E. tschifuensis* a specimen from Chefoo, Shantung, that differs from a Peiping specimen merely in having a somewhat larger skull, and the forehead and snout a darker brown, nearly "drab." It is, however, an aged example which would account for its large size, while the color, though darker than usual, is doubtless an individual variation. Thomas (1909, p. 966) in recording two other specimens of *E. dealbatus* from the same locality, does not regard them as different. The skulls of two other Shantung hedgehogs before me are slightly smaller. In the same paper, Matschie names as new species, *E. kreyenbergi* and *E. hanensis*. The former is based on a specimen purchased in the Shanghai Market and is characterized as having the snout, sides of head and the under side ochraceous, the chest brighter ("ockerrot"), forehead buff, feet dark ochraceous brown; the latter species is described from a skin from Hankow which seems to differ from the Peiping specimen in having the head, feet, and under side dark hair-brown mixed with gray, instead of being pale whitish. Nothing is said of the skulls of either, and both may for the present be best regarded as identical

with *E. dealbatus* of which they represent color variations. I had previously (G. M. Allen, 1912, p. 242) referred to *E. hanensis* an immature male from Ichang, in which the lower surfaces are gray with a decided pinkish wash, but I now regard this as also a color variation of the same, for evidently there is much variety in the exact tint of the hairy coat.

Satunin's *Erinaceus chinensis* from Khingan, Manchuria ("Tyntza-intza"), although outside the area covered, may be briefly noticed here. The single specimen upon which it is based is evidently large, but in color does not appear to differ from what is sometimes found in the present form. Indeed, Satunin (1907a, p. 175) admits that he would not be surprised "wenn mit der Zeit, nach Untersuchung grösseren Materials, dieser Igel als identisch mit *Er. dealbatus* sich erweist." It is possibly an intermediate toward the larger and darker eastern form *E. amurensis*.

I would also include as a synonym, *E. hughi* Thomas, the type of which I examined at the British Museum. It is an unusually dark individual, nearly lacking the all-white spines.

Occurrence and Habits:—These hedgehogs occur locally over much of northern China, but seem to be somewhat sporadic in distribution, common in certain areas and rare or unknown in others. In general they are found in the northeastern part of the country as far south at least as the Yangtze basin, and as far west as the borders of the western highlands on the frontiers of Szechwan. Swinhoe (1870b) described the animal on the basis of specimens from Peiping, where he regarded it as common, adding (1870c, p. 621) that it is said to occur at Amoy and in Hainan, as well as "lately at Swatow," Kwangtung. Probably, however, it does not occur much to the south of the Yangtze basin, and its supposed presence in Hainan, as perhaps also in Swatow, has never been corroborated and is probably based on reports of porcupines. The evidence for its having been found at Amoy rests on the statement of Swinhoe (1864a) that hedgehogs, said to have been locally obtained, have been offered for sale in the market there. Probably, however, these captives were from much farther north, while the basis of the Swatow record is not further stated. The predilection of the Chinese for keeping pets is well known, so that little weight can be given to locality records based on animals purchased in the markets. Mell, who spent several years collecting in Kwangtung, makes no mention of these animals in the list of the mammals he found. The hedgehog is apparently commonest in the northern part of China, where it seems to thrive in spite of man and his works. In addition to Swinhoe's record of its being common about Peiping (Hopei), Lönnberg (1922) mentions specimens from the same province (Miyuanhsien, Shunihsien, and Niulangshan), and Jacobi (1922, p. 2) records other specimens from Peiping, collected by the Stötzner

Expedition, while Dr. R. C. Andrews secured one at Eastern Tombs, to the northeast. Still farther east, Howell (1929, p. 6) records two from Tientsin, Hopei. This hedgehog seems to be still not uncommon in Shantung, despite the long period of intensive cultivation and denudation. In addition to the large individual from Chefoo, made by Matschie the type of his *E. tschifuensis* (in the Berlin Museum), Thomas (1908d, p. 6) records a male and a female from the same locality, adding the note of Malcolm P. Anderson, the collector, that these were purchased alive from peasants who had brought them in; he also mentions (1909, p. 966) one received from Swinhoe. Anderson says that, although he failed to secure any himself, in the course of some two months' collecting, they were apparently "not uncommon" and strictly nocturnal. In the same province, Dr. A. Jacot has sent me the skull and a skeleton of this animal from Tsinan, where they were taken on the campus of Shantung Christian University. He writes: "We are in the center of a semiarid region that has been under intensive cultivation for 2000–4000 years, and the Chinese have long ago eliminated anything at all edible. There are no woodland tracts in this Province to my knowledge. The hills have been deforested and are grubbed monthly of shrubs for fuel. Thus only the most adaptable animals have survived."

Farther south, Sowerby (1929c) who has had long experience in China, says that hedgehogs are found at least as far as Chekiang Province, coastwise; probably Matschie's type specimen of *E. kreyenbergi* (in the Magdeburg Museum) purchased in the Shanghai Market, came from no great distance. Howell (1929) lists (under *Erinaceus hanensis*) two specimens from Shanghai in the U. S. National Museum, one from Ningpo, Chekiang, and others from Yochow, Hunan, whence also the American Museum has a specimen, and in addition one from Wuhu, Anhwei; these and the type of *E. hanensis* Matschie from Hankow, eastern Hupeh, and the specimen in the Museum of Comparative Zoölogy from the western part of the same province, at Ichang, very likely indicate roughly the southern range. The northwestward limits are perhaps in central Shansi. M. P. Anderson (in Thomas, 1909) states that it is unknown about Paotehchow, at the edge of the Ordos Desert, but he had reports of it at Ningwufu in the central parts of the province. In the more arid Shensi Province it doubtless grades into the following subspecies, *E. e. miodon*, if that proves eventually to be distinct.

Sowerby (1914, p. 56), in brief notes on the Chinese hedgehogs, writes that in Hopei they are looked upon as sacred animals by the Chinese and so are not molested, but on the contrary, little shrines are often built for them. This may in part account for their comparative abundance in parts of this province, for elsewhere they are often eaten, and Sowerby recounts that in

Manchuria the woodsmen prepare them for eating by first encasing them in a coating of mud, which, after the animal has been roasted whole in the embers of a wood fire, comes away with the spines, hair, and skin adhering to the clay, "leaving a very toothsome morsel of beautifully cooked meat." He adds that foxes often kill hedgehogs by thrusting their snout under the spiny ball, and throwing the animal into the air. "This makes the hedgehog uncurl, and, before it can curl up again, the fox has nipped it in the unprotected vitals."

Specimens examined:—In all, sixteen, as follows:

Hopei: Eastern Tombs, 1; Peiping, 1 (type, B.M.); northeastern Hopei, 1 (B.M.).
Hunan: Yochow, 1.
Anhwei: Wuhu, 1.
Hupeh: Ichang, 1 (M.C.Z.).
Kiangsu: Nanking, 3 (Univ. Mich.); Shanghai, 1 (B.M., topotype of *E. kreyenbergi*).
Shantung: Tsinan, 2 (M.C.Z.), 1 (B.M.); Chefoo, 2 (B.M.).
Shensi: Paochi, 1 (B.M., type of *E. hughi*).

9. **Erinaceus europæus miodon** Thomas

Erinaceus miodon Thomas, Abstract Proc. Zool. Soc. London, Dec. 15, 1908, p. 44; Proc. Zool. Soc. London, for 1908, p. 965, 1909.
Hemiechinus miodon Lönnberg, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 626, 1922.

Type specimen:—An adult male, skin and skull, No. 9.1.1.9, British Museum, from Yulinfu, Shensi, China, 4,000 feet altitude. Collected by Malcolm P. Anderson, in May, 1908.

Description:—In size and general proportions resembling *E. europæus dealbatus*, but the spiny coat almost wholly lacks the all-white spines generally present in the latter. The spines are about 22–24 mm. long on the back, white for two-thirds their basal portion, then broadly ringed with blackish brown, the ring some 4 mm. wide, tipped with white for about an equal breadth, or sometimes the extreme tip minutely dark. The hairy coat of the head, sides, limbs, and tail is variable, as in *E. e. dealbatus*, in some a dull whitish or brownish white to distinctly brown ("broccoli brown"). The belly is usually somewhat paler, varying to dull white. The type series is apparently in winter pelage still or in process of changing, so that the paler parts may represent the old fur of the latter.

The skull differs from that of more typical *E. e. dealbatus* in having (in all but two of the nine specimens) the tip of the premaxillary process more slender and continued back to nearly or quite meet the anterior point of the frontal, completely shutting off the maxillary from contact with the nasals.

Measurements:—The dimensions do not seem to be essentially different from those of *E. e. dealbatus*, although but few for the latter are available. The collector's measurements for the type series are as follows:

No.	Head and body	Tail	Hind foot	Ear	Locality
9.1.1.2 BM	205	35	39	28.0	Shensi
9.1.1.3 BM	176	34	36	24.0	Shensi
9.1.1.4 BM	195	35	36	27.0	Shensi
9.1.1.5 BM	205	37	36	33.0	Shensi
9.1.1.6 BM	175	37	38	29.0	Shensi
9.1.1.7 BM	175	31	36	29.0	Shensi
9.1.1.8 BM	192	40	35	28.0	Shensi
9.1.1.9 BM (type)	215	46	40	34.5	Shensi
9.1.1.10 BM	214	43	37	30.0	Shensi

For cranial measurements of this series, see table under *E. e. dealbatus*.

Nomenclature:—This hedgehog at first sight does not seem very different from some specimens of *E. e. dealbatus*, but the entire series is uniform in lacking the usual intermixture of all-white spines, common in that race, and the attenuated premaxillary extending rather far back is also different. Lönnberg (1922) concluded that *E. miodon* is really one of the *Hemiechinus* group, but after seeing the original specimens in the British Museum, I agree with Thomas that its relationships are after all with *Erinaceus e. dealbatus*, and that it constitutes a local race of the desert country bordering the Ordos.

Occurrence and Habits:—Hitherto this hedgehog is recorded from the type locality only, Yulinfu, in northwestern Shensi, close to the border of the Ordos Desert, and hence not far from the area inhabited by *Hemiechinus dealbatus alaschanicus*. Clark and Sowerby (1912, p. 22) write that "the country about Yü-lin Fu is wild and inexpressibly dreary. Very few trees are to be seen, and the bare brown cliffs and yellow sand are devoid of any vegetation, save an occasional tuft of some sage scrub. In places, especially where, as in the northeast, it rises to any prominence, gloomy chasms, with deadly quicksands lurking in their depths, gape in the sandstone and the half-formed shale. To north and west the prospect is heart-breaking. Sand-dunes and sand-dunes, and again sand-dunes—shifting with every storm and obliterating every landmark. Only here and there, as tiny islands in a sea of desolation, small clusters of mud huts, where some little oasis marks the site of a spring or well." Malcolm P. Anderson, who collected the series of nine upon which the form was described, notes (Thomas, 1909, pp. 964, 966) that "the portion of Shen-si visited appears indeed like an extension of the plateau of which Ordos is part, only this extension has been cut into by a great many perennial streams, a process which is now taking place in southern Ordos." Of the hedgehogs, he adds, "There appear to be large areas in North China where the Hedgehog is not found at all, and some places, of which the neighbourhood of Yu-lin-fu is one, where they are remarkably common. At the time we were at Yu-lin

(April to May) the neighbouring desert was alive with several species of beetle upon which the Hedgehog fed. . . . Chinese name, 'Tsi-wei' (tsi- a thorn or spine)." Sowerby (Clark and Sowerby, 1912, p. 83), who visited the type locality shortly after, was unsuccessful in securing additional specimens, for on account of the lateness of the season (last of October), he found this and many other small mammals already gone into hibernation.

Specimens examined:—Nine, the original series in the British Museum, from Yulinfu, northern Shensi.

Family TALPIDÆ

MOLES

This family includes the mole-like insectivores, chiefly modified for a fossorial life through the specialization of the fore feet and anterior part of the body for pushing a way through loose soil. The head is tapering, the external ears small or absent, the neck short and muscular. The muscles of shoulder and arm are enlarged and powerful, their bones short and strong, with the clavicle and humerus especially well developed, the latter, however, retaining its entepicondylar foramen. All five fingers are present on the fore feet, each provided with a stout claw, and in the more strictly fossorial types, the entire hand is so rotated that the foot seems to be set on edge, with the palm turned out. The skull lacks prominent ridges for muscle attachment, but its component bones fuse at an early age. The zygomatic arch is still present though slender, and the teeth retain a primitive sectorial type, with sharp cusps on the upper molars tending to form a W-pattern. The tympanic bone fuses to the skull, forming a low, rounded bulla.

Thomas (1912d), in a discussion of the family, regards it as divisible into five subfamilies, of which the Desmaninæ and the Condylurinæ are aquatic in habits, the former confined to western Siberia and southern Europe, the latter to eastern North America. Representatives of the three remaining subfamilies occur in China, the most primitive, the Uropsilinæ, including species of the Chinese highlands that retain an almost shrew-like form, without special fossorial modifications; the two other groups, the Talpinæ or more typical moles, and the Scalopinæ with one Chinese genus and other American forms, are modified for underground life.

Key to the Genera of Chinese Talpidae

A. Form shrew-like, with long snout, slender tail, feet not modified for digging; 2 anterior upper incisors much larger than the canine and anterior premolars immediately following.
  a. Nine teeth in the upper jaw, eight in the lower ..... *Uropsilus*
  b. Ten upper and nine lower teeth.
    a′. With two lower incisors and three lower premolars ..... *Rhynchonax*
    b′. With only one lower incisor and four lower premolars ..... *Nasillus*

B. Form thickset for burrowing, snout shorter, tail about twice the length of hind foot or much less; fore feet broadened and the fore claws lengthened for digging.
  a. Anterior incisors small, followed by an enlarged canine; tail about as long as hind foot.
    a′. Eleven teeth in each jaw..... *Talpa*
    b′. Teeth less than eleven in each jaw.
      1. Upper premolars three, two small and one large; lower four. *Parascaptor*
      2. Both upper and lower premolars three only..... *Scaptochirus*
      3. Teeth as in *Talpa* but lower canine lacking, making the fourth tooth close *behind* the upper canine..... *Mogera*
  b. Anterior incisors larger than the succeeding teeth, tail twice as long as the hind foot.
    a′. Upper teeth eleven, lower ten in number, fore feet less broadened. *Scaptonyx*
    b′. Upper teeth nine, lower nine in number, fore feet broader..... *Scapanulus*

Genus **Uropsilus** Milne-Edwards

Uropsilus Milne-Edwards, in David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 92, 1871. Milne Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 272, 1868-74.

The insectivores of this group are of special interest as representing the most primitive of the living mole-like species, in which the bodily form is still essentially shrew-like, with none of the characteristic adaptations of the burrowing types. The snout is very long, with a cartilaginous tubular prolongation beyond the fore part of the skull; the external ears are well developed and reach the height of the surrounding fur; the tail is long, slender and covered with rings of small scales, while the fore feet are provided with slender toes, each with a compressed instead of a flattened claw. The backs of both hands and feet are scaly, and according to Milne-Edwards the bones of the ungual phalanges are entire instead of bifurcate as in the typical moles.

The skull with its rounded outlines and complete zygomatic arch is essentially mole-like, however, and the teeth resemble those of most moles in the enlargement of the first incisors and reduction of the succeeding teeth, without the extreme lengthening of the first lower incisors, found in the soricids. In the type species, *U. soricipes*, described by Milne-Edwards from Muping, Szechwan, the tooth formula is given as of nine upper and eight lower teeth on each side, as follows: i.$\frac{2}{1}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{3}{3}$ = 34. These are interpreted by Thomas (1912e, p. 129) as representing the following teeth: i.$\frac{1 \cdot 2 \cdot 0 \cdot}{0 \cdot 2 \cdot 0 \cdot}$ c.$\frac{1}{1}$ pm.$\frac{1 \cdot 2 \cdot 0 \cdot 4 \cdot}{1 \cdot 2 \cdot 0 \cdot 4 \cdot}$ m.$\frac{1 \cdot 2 \cdot 3 \cdot}{1 \cdot 2 \cdot 3 \cdot}$ There seems, however, to be a curious variation in the number of the small premolars and lower incisors that may be present, variations which are apparently of a definite sort, although accompanied by little if any external difference. The commoner of these seems to be the presence of four upper premolars associated with two lower incisors, while the less usual one is the presence of four upper and four lower premolars, but in other respects the formulæ are as given above. Thomas has regarded these

as indicating two additional genera, which he names *Rhynchonax* and *Nasillus* respectively. It is still uncertain whether they express merely fluctuating conditions in the presence or absence of nearly functionless teeth in process of disappearance in a single generic type, or whether they are correlated with other differences that would distinguish related groups, which, though perhaps occurring together in the same general area, nevertheless do not intercross and so are to be regarded as distinct. A conservative course might be either

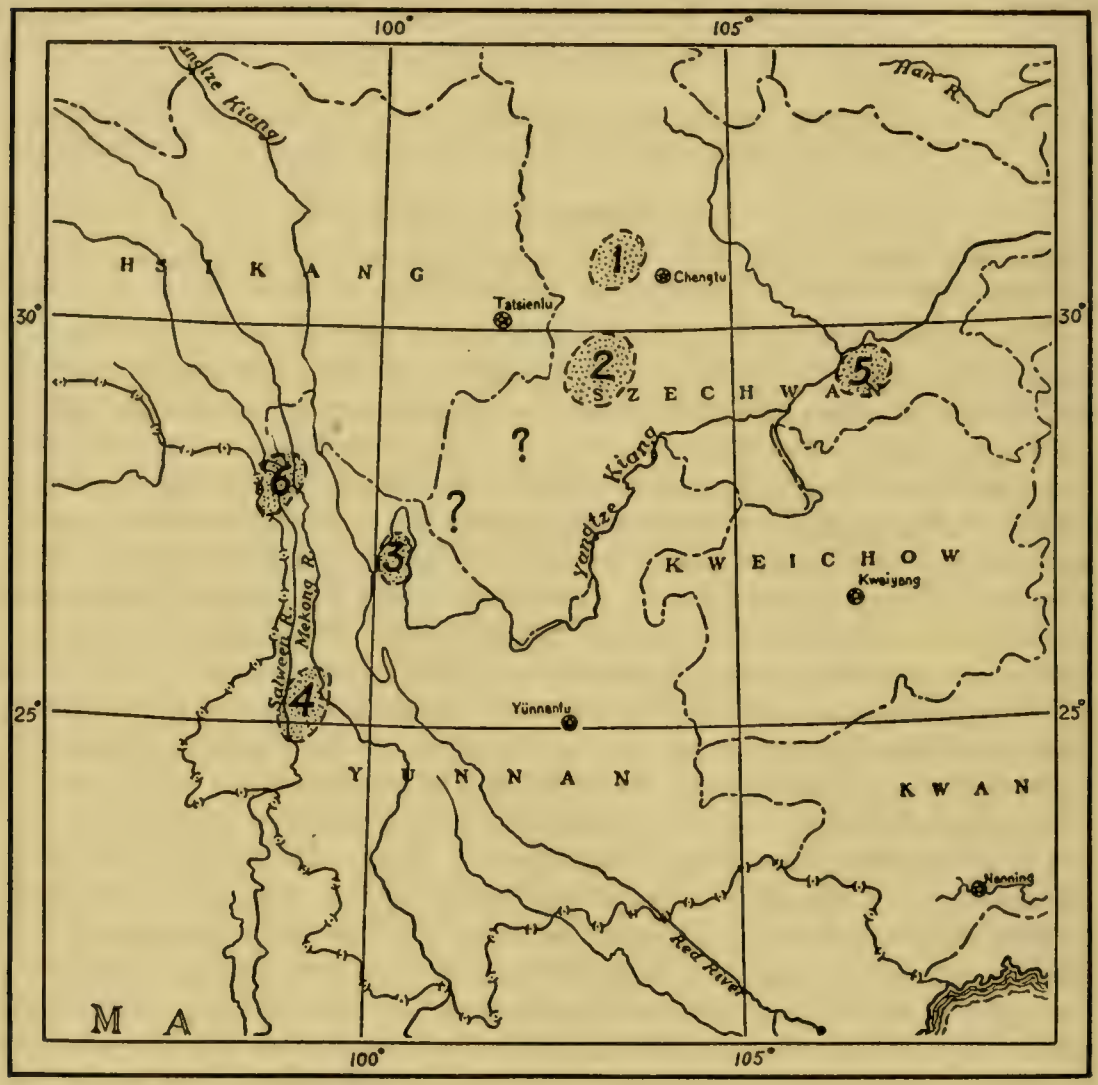

FIG. 3. Distribution Map.

Uropsilus
1. *U. soricipes*

Rhynchonax
2. *R. andersoni andersoni*
3. *R. andersoni nivatus*
4. *R. andersoni atronates*

Nasillus
5. *N. gracilis*
6. *N. investigator*

to consider all three described genera as one, with definite variations among the disappearing teeth of a dentition in course of reduction, or to recognize all three at present as representing truly distinct groups of a primitive stock, until sufficient evidence is obtained to warrant a definite conclusion. The second alternative is here accepted, and the three genera treated as valid until they can be shown to be otherwise. The fact that, so far as the available specimens indicate, these three groups seem to have fairly distinct areas of geographical distribution, may be interpreted as favoring their distinctness.

10. **Uropsilus soricipes** Milne-Edwards

Uropsilus soricipes Milne-Edwards, in David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 92, 1871. Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 272, pl. 40, fig. 1; pl. 40A, fig. 1, 1868-74.

Type specimen:—No type specimen is mentioned in the original description, which, however, was evidently based on an individual sent in alcohol to the Muséum d'Histoire Naturelle at Paris by Père Armand David, who collected it in the principality of Muping, Szechwan, China.

Description:—Upper surface of head and body dark brown, near "Prout's brown" of Ridgway; below dark slaty. Tail and backs of feet dark brown, scaly, with minute blackish hairs growing from between the scales.

The skull has a full, rounded brain case, slender up-curved zygomatic arches, and a tapering rostrum which is slightly depressed anterior to the orbits. In side view, as seen in Milne-Edwards's Plate 40A, the first incisor of each side above is only slightly larger than the second, but set with its broad axis transverse to the long axis of the skull so that the two of opposite sides together form a sharp cutting edge. The two teeth following the second incisor are hardly one-third the size of that tooth, single-rooted, and interpreted as a canine and premolar 1, short and bluntly conical. The two other premolars are larger, practically in contact, and the fourth exceeds the one in front of it, interpreted as pm^2. The two anterior molars have the usual cusps well developed, forming with their commissures a W-pattern, which in the third molar is reduced through the loss of the posterior commissure of the metacone and the suppression of the hypocone. In the lower jaw the single large incisor corresponds to the upper, and is succeeded by three unicuspids, increasing slightly in size from first to last (regarded as a canine and two premolars), while the third premolar is larger, and in close contact with that in front.

Concerning the skeleton, Milne-Edwards states that the vertebræ number seven cervicals, thirteen dorsals, seven lumbars, five sacrals, and fourteen caudals, total 46. The manubrium of the sternum is laterally compressed below, but does not show the definite keel characteristic of the typical moles, and the hand lacks the falciform bone. The clavicles are relatively weak, but the

humerus, though slender and shrew-like, has nevertheless prominent muscle crests. The terminal phalanges of the hand are normal in form without the cleft appearance found in the moles, in which the heavy claws require this extra means of support.

Measurements:—The measurements of the type specimen and the two others secured by the Duke of Bedford's Expedition are as follows:

No.	Head and body	Tail	Hind foot	Ear	Locality
PARIS	63	64	15	—	Szechwan
11.9.8.12 BM	72	65	15	10	Szechwan

CRANIAL MEASUREMENTS OF *UROPSILUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width outside molars	Upper cheek teeth	Lower cheek teeth	Locality
11.9.8.11 BM	——	——	10.5	10.9	——	8.0	9.7	9.0	Szechwan
11.9.8.12 BM	21.2	17.5	10.5	11.1	11.6	7.0	9.6	9.1	Szechwan
PARIS (type)	21.0	——	——	——	11.0	——	——	——	Szechwan

Occurrence and Habits:—This remarkable species, a sort of annectant type between the moles and the more primitive insectivores from which they must have sprung, was first discovered by Père David, who in the course of his exploration in western Szechwan, in 1870, sent back specimens to the Paris Museum, which were later described and figured by Milne-Edwards. No further record of the animal occurs for some thirty years, until Pousargues (1896a, p. 179) recorded a specimen from Yunnan, brought back by Prince Henri d'Orléans. However, the later discovery of the very similar genus *Rhynchonax* as a common species in that province raises the presumption that in the light of more recent knowledge, this specimen might prove to be a member of the latter genus. It was not until 1912 that Thomas (1912e, p. 129) discovered the fact that typical *Uropsilus*, as shown by examination of examples from Père David's original series, has a slightly different tooth formula from the one more common in specimens he had hitherto referred to this genus, leading him to reëxamine the entire lot acquired shortly before by the Duke of Bedford's exploration under Malcolm P. Anderson. He showed that *Uropsilus soricipes*, characterized by the possession of nine upper and eight lower teeth, is known only from the original series from Muping and from two males having the same formula, taken by Anderson only a short distance to the northeast of the original locality, at Weichow, sixty miles northwest of Chengtu, Szechwan, in the narrow valley of the Sungpan Ho. Apparently, then, this variation, in which the small upper premolar, between the two large ones, and the second lower incisor are lacking, is confined to the region of Muping and slightly to the east, while to the southeast and southwest two other variations occur, each of which Thomas has regarded as typifying distinct genera, *Nasillus* and

Rhynchonax, respectively. In a previous paper (G. M. Allen, 1912), I regarded all these variations as merely individual and indicative of a tooth formula in active process of reduction through the variable presence or absence of one or two of the minute teeth in one or both jaws. The fact that these variations seem in some degree correlated with an area of distribution, however, lends color to Thomas's view that they represent distinct genera, but the external similarity of the animals points to their essential specific unity. Awaiting further knowledge, therefore, it seems best to let Thomas's genera stand provisionally as a group of closely related forms, of which typical *Uropsilus soricipes* is the most northeastern in distribution, confined to a narrow area in Szechwan.

Specimens examined:—Two, from Weichow, Szechwan (B.M.).

Genus **Rhynchonax** Thomas

Rhynchonax Thomas, Proc. Zool. Soc. London, 1912, p. 129. Type, *Rhynchonax andersoni* Thomas.
Uropsilus Thomas, Proc. Zool. Soc. London, 1911, p. 163. G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 239, 1912 (in part).

This genus chiefly differs from other members of the subfamily in the retention, usually, of a minute upper premolar (pm^3) and a lower incisor (i_3), in addition to the number present in *Uropsilus*, making in all ten upper and nine lower teeth. In external characters the two are alike.

As mentioned under *Uropsilus*, it is a question whether the presence or absence of the extra minute tooth above and below is to be regarded as sufficient basis in this case for a generic separation. In 1912, I inclined to the view that it was not, especially since a series from Wa Shan, somewhat to the southward of Muping, showed an additional variation in sometimes lacking the minute upper premolar, although with nine lower teeth. Thomas, who later examined one of the specimens, wrote me that he regarded them all, nevertheless, as *Rhynchonax*. Thus it appears that the latter may sometimes lose the upper minute premolar (Thomas writes that its alveolus can be made out in the specimen sent him from our series), while still retaining the extra lower one; or, as in some of the Wa Shan series, the reduction may go so far that not only is there no alveolus to be made out, but the space where the tooth stood is nearly obliterated by the close approximation of the two large premolars. Thomas believes further that the color of the two genera is slightly but recognizably different.

11. **Rhynchonax andersoni andersoni** Thomas

Rhynchonax andersoni Thomas, Abstract Proc. Zool. Soc. London, October 31, 1911, p. 49; Proc. Zool. Soc. London, 1912, p. 130.
Uropsilus soricipes Thomas, Proc. Zool. Soc. London, 1911, p. 163. G. M. Allen, Mem. Mus. Comp. Zoöl., vol. 40, p. 239, 1912 (not Milne-Edwards). ? Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 2, p. 179. 1896 (? in part).

Type specimen:—Adult male, skin and skull, No. 11.2.1.25, British Museum, from Omei Shan, Omei Hsien, southern Szechwan, 9,500 feet.

Description:—General color above a dark brown, near "clove-brown" to "bister" (Thomas); below dark slaty. Tail dark brown all around, with rings of minute scales, between which are very small bristles of about the length of a single ring, except toward the tip, where they are longer, tending to form a short pencil.

As already noted, the tooth formula is normally greater by one upper premolar and one lower incisor than that of *Uropsilus*, and the color is darker.

Measurements:—The following are measurements of the British Museum series, those of the exterior made in the field by the collector.

No.	Head and body	Tail	Hind foot	Locality
11.2.1.26 BM	67	65	14.5	Szechwan
11.2.1.27 BM	70	67	15.0	Szechwan
11.2.1.28 BM	71	65	15.0	Szechwan
11.2.1.29 BM	67	68	15.5	Szechwan
11.2.1.31 BM	69	68	15.5	Szechwan
11.2.1.25 BM (type)	70	67	15.5	Szechwan

CRANIAL MEASUREMENTS OF *RHYNCHONAX*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
				R. andersoni andersoni					
11.2.1.25 BM	21.0	17.3	10.1	11.1	11.5	6.6	9.2	8.6	Szechwan
11.2.1.26 BM	21.7	16.7	9.8	10.6	11.5	6.3	9.4	8.6	Szechwan
11.2.1.30 BM	22.1	17.3	10.3	10.4	11.5	6.8	9.7	9.1	Szechwan
11.2.1.31 BM	21.6	17.3	9.9	10.4	11.6	6.8	9.6	9.4	Szechwan
7520 MCZ	21.7	17.1	10.5	10.5	11.2	6.6	9.6	9.0	Szechwan
7521 MCZ	21.1	16.7	9.8	10.5	11.5	6.1	9.5	8.6	Szechwan
7523 MCZ	20.4	16.6	9.8	9.9	11.2	6.5	9.3	8.6	Szechwan
7524 MCZ	22.0	17.5	10.2	11.1	11.7	6.8	9.8	8.6	Szechwan
7527 MCZ	22.0	17.5	10.2	10.4	11.4	6.7	9.7	9.0	Szechwan
				R. andersoni atronates					
44344	20.0	16.6	9.4	——	10.5	5.8	8.7	8.2	Yunnan
44340	20.0	16.6	9.2	——	10.9	6.3	8.5	7.8	Yunnan
				R. andersoni nivatus					
44361	20.3	16.2	9.8	——	11.3	6.2	8.9	8.0	Yunnan
44364	19.9	16.0	9.3	9.7	10.5	6.0	9.2	8.0	Yunnan

Occurrence and Habits:—So far as at present known, this seems to be a slightly more southern animal than *Uropsilus* in its general distribution. The type and eight others were taken by Malcolm P. Anderson at Omei Shan, Omei Hsien, in central Szechwan. In addition, a small series of seven was secured for the Museum of Comparative Zoölogy by Walter R. Zappey, in 1908, at

Wa Shan, slightly south of the same place, and a single one each from Lianghokow and Tachiao in the same general area (not Taochow, Kansu, as Howell, 1929, p. 7, suggests). Probably the animal occurs in typical form over central Szechwan into northern Yunnan, but there seem to be no other authentic records. Specimens secured by the American Museum Asiatic Expeditions in southern Yunnan are sufficiently different to warrant separation as subspecies.

Specimens examined:—In all, eighteen, as follows:
Szechwan: Lianghokow, 1 (B.M.); Omei Shan, 9 (B.M.); Tachiao, 1 (U.S.N.M.); Wa Shan, 7 (M.C.Z.).

12. **Rhynchonax andersoni atronates** G. M. Allen

Rhynchonax andersoni atronates G. M. Allen, Amer. Mus. Novitates, no. 100, p. 2, December 28, 1923.

Type specimen:—A female, skin and skull, No. 44343, American Museum of Natural History, from Mucheng, Salween drainage, southwestern Yunnan, China, altitude 7,000 feet. Collected February 13, 1917, by Dr. R. C. Andrews and Edmund Heller.

Description:—A dark form, the rump nearly unmixed slaty black; skull smaller, with the third upper premolar less reduced than in typical *R. andersoni.*

General color above nearly "Prout's brown" (of Ridgway). The pelage consists of shining black hairs, mixed with others that are blackish slate basally, tipped with hazel. On the rump the latter hairs are few or absent, giving a strikingly blackish appearance to this region. The lower surfaces of body and limbs are uniform blackish slate. Backs of feet and entire tail scaly, with minute scattered blackish hairs; the tail usually not paler underneath.

The skull is smaller than in typical *R. andersoni* of Szechwan, and the teeth are smaller throughout, except that the third upper premolar, which in the latter is minute or sometimes wanting altogether (with about half the crown area of the first and barely reaching the level of the cingulum of the two adjoining it), is in this Yunnan animal much larger, of about the same crown area as the first premolar, with cingulum and crown well developed, the tip of the tooth standing well above the general cingulum level. In the lower jaw, the second incisor, instead of being minute, is as large as the canine, and the small second premolar (p_2), though slightly smaller than the canine, is nevertheless much better developed than in typical *R. andersoni,* in which it is very minute or sometimes altogether absent.

Measurements:—The external measurements are practically the same as in *R. andersoni.* The type measures: head and body, 67 mm.; tail, 57; hind foot, 14; ear, 10.

For skull measurements, see table under *R. andersoni andersoni.*

Occurrence and Habits:—Specimens of this genus were obtained at only two localities in southwestern Yunnan by the American Museum Asiatic Expeditions, at Mucheng on the Salween drainage (sixteen), and again at Peitaiping, where a single one was secured. The slight differences in color are of less importance probably than the less reduced condition of the teeth in this more southern animal.

Specimens examined:—Seventeen, as follows:

Yunnan: Mucheng, 6,000-7,000 feet, 16; Mekong drainage, Peitaiping, 9,000 feet, 1 (in alcohol).

13. **Rhynchonax andersoni nivatus** G. M. Allen

Rhynchonax andersoni nivatus G. M. Allen, Amer. Mus. Novitates, no. 100, p. 2, December 28, 1923.

Type specimen:—Male, skin and skull, No. 44352, American Museum of Natural History, from Ssu Shan (Snow Mountain), Likiang Range, western Yunnan, China, at 12,000 feet altitude. Collected October 22, 1916, by Dr. R. C. Andrews and Mr. Edmund Heller.

Description:—Similar to typical *R. andersoni* but much paler brownish, with a smaller skull and larger third upper premolar.

In size and cranial characters, this subspecies resembles the preceding but is much paler brown above, nearly light cinnamon brown, almost of the same tint as our *Sorex cinereus;* it lacks the blackish rump of *R. andersoni atronates*, and the tail is indistinctly bicolor. The fore legs and under parts are "deep neutral gray" (Ridgway), much paler than in *R. andersoni* from Szechwan. In certain lights the tips of the hairs appear glistening. Tail fuscous above, paler below.

The skull is smaller than in the typical form and closely resembles that of *R. andersoni atronates*. The third upper small premolar is as large as the first, stands well in the tooth row with its cingulum level with those of the adjacent teeth, and has a distinct crown about as high as the width of the cingulum. The second lower incisor is larger than the lower canine, and hence much larger than in the typical form.

Measurements:—The type measured in the flesh: head and body, 68 mm.; tail, 60; hind foot, 15.

For cranial measurements, see table (p. 60) under *R. a. andersoni.*

Occurrence and Habits:—The discovery of this animal on the isolated Likiang Range at altitudes of from 10,000 to 12,000 feet by Dr. Andrews's expedition extends the known range of the genus considerably to the southwest. No doubt intergradation with the preceding race takes place at lower levels to the northward, but as with many other species this seems to have developed a local form on this range cut off in the loop of the Yangtze. While resembling

R. a. atronates in cranial and tooth characters, the color is so strikingly different that the Likiang specimens can be picked out at once from a mixed series. The large size of the third upper premolar and the second lower incisor in these southern races, as contrasted with their reduced size in the typical animal to the northward, lends color to the argument that we have in these and *Uropsilus* a progressive series in reduction of these teeth, culminating at the northward limits of the range in their loss, in what is here called *Uropsilus soricipes;* so that it may be that we have to do really with but this single species, of which the forms of *Rhynchonax* may be regarded as subspecies. It is peculiar that all the specimens taken were males.

Specimens examined:—Nine, from Yunnan: Likiang Range, Ssu Shan (Snow Mountain), 10,000–12,000 feet.

Genus **Nasillus** Thomas

Nasillus Thomas, Abstract Proc. Zool. Soc. London, October 31, 1911, p. 49; Proc. Zool. Soc. London, 1912, p. 129.

While having the same number of teeth, ten above and nine below, as *Rhynchonax*, the formula differs in that but one instead of two lower incisors is present, with all four lower premolars instead of only three. Thomas has interpreted the teeth as follows: $i.\frac{1\cdot2\cdot0\cdot}{0\cdot2\cdot0\cdot}$ $c.\frac{1}{1}$ $pm.\frac{1\cdot2\cdot3\cdot4\cdot}{1\cdot2\cdot3\cdot4\cdot}$ $m.\frac{1\cdot2\cdot3\cdot}{1\cdot2\cdot3\cdot}$ $= \frac{10}{9}$ or 38 in all. In general appearance this genus externally is similar to *Uropsilus* but slightly smaller. It may again seem possible that the variation in tooth formula is not a matter of generic value, but Thomas, after careful study of the three types of formulæ, has reached the conclusion that in the present case a separate genus should be recognized, with *Nasillus gracilis* as its type.

14. **Nasillus gracilis** Thomas

Nasillus gracilis Thomas, Abstract Proc. Zool. Soc. London, October 31, 1911, p. 49; Proc. Zool. Soc. London, 1912, p. 130.

Type specimen:—A female, skin and skull, No. 11.9.1.13, British Museum, from Chinfu Shan, near Nanchwan, southeastern Szechwan, China.

Description:—Externally resembling *Uropsilus* and *Rhynchonax*, the general color above is near "sepia," much as in *Uropsilus soricipes*, not so dark as in *Rhynchonax andersoni;* below slaty. Hands and feet pale brown, the tail uniformly brown.

The skull is shorter and decidedly narrower than in either of the two related genera, with a less-expanded brain case. The upper third premolar (absent in *Uropsilus* and minute in *Rhynchonax andersoni*) has the crown as large as the small anterior premolar; in the lower jaw the minute incisor stand-

ing just back of the large anterior incisor in the latter species, is quite lacking, but there is a very minute second lower premolar, the smallest tooth in the jaw. Hence, although the same number of teeth is present as in *Rhynchonax*, their interpretation is different.

Measurements:—Thomas gives the following measurements of the type and only known specimen, and points out that the hind foot is proportionately smaller than in the related genera *Uropsilus* and *Rhynchonax:* head and body, 66 mm.; tail, 55; hind foot, 13.5; ear, 9.

For cranial measurements see the table under *N. investigator*.

Occurrence and Habits:—This species is known only from the single specimen taken at Chinfu Shan, near Nanchwan, in southeastern Szechwan, which is apparently the most eastern point known for the occurrence of a member of this group. The altitude is about 4,000 feet.

Specimens examined:—One, the type, from Nanchwan, Szechwan (B.M.).

15. **Nasillus investigator** Thomas

Nasillus investigator Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 393, 1922.

Type specimen:—Skin and skull, No. 22.9.1.16, British Museum, from the Kiukiang-Salween divide, at 28° north, northwestern Yunnan, China. Collected July 24, 1921, by George Forrest.

Description:—Externally similar to *N. gracilis*, "indeed, all the members of the three genera *Uropsilus*, *Rhynchonax* and *Nasillus* are hardly distinguishable from each other" (Thomas), externally, except that the members of *Rhynchonax* are noticeably more blackish.

The skull differs from that of *N. gracilis* in being longer with a wider brain case. The skull of the type, though still retaining milk teeth, is said by its describer to be quite of full size, and in its tooth formula agrees with that of *N. gracilis*, as do also the five other specimens taken at the same time and place.

Measurements:—The original series and another from Gomba-la were measured by the collector as follows:

No.	Head and body	Tail	Hind foot	Ear	Locality
22.9.1.13 BM	80	54	16	9	Yunnan
22.9.1.14 BM	83	59	14	10	Yunnan
22.9.1.15 BM	80	66	15	8	Yunnan
22.9.1.16 BM (type)	88	62	14	10	Yunnan
22.9.1.17 BM	74	74	14	9	Yunnan
22.9.1.18 BM	78	75	15	9	Yunnan
22.9.1.19 BM	67	64	15	10	Yunnan
23.3.7.7 BM	70	72	13	10	Yunnan

CRANIAL MEASUREMENTS OF *NASILLUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
				N. investigator					
22.9.1.15 BM	21.2	——	9.9	——	——	6.7	9.7	9.0	Yunnan
22.9.1.16 BM (type)	21.3	——	9.6	10.2	11.1	6.5	9.2	8.6	Yunnan
22.9.1.17 BM	——	——	9.7	——	——	6.6	9.4	8.8	Yunnan
22.9.1.18 BM	21.8	17.4	10.1	9.6	11.5	6.8	9.7	8.9	Yunnan
22.9.1.19 BM	21.8	——	9.7	10.8	11.3	6.5	9.2	8.6	Yunnan
				N. gracilis					
11.9.8.13 BM (type)	21.3	16.3	9.2	9.6	10.4	6.2	8.9	8.1	Szechwan

Occurrence and Habits:—Seven specimens in all were obtained by Forrest at or near the type locality, all of which agree in tooth formula, thus additionally confirming Thomas's view of the distinctness of the genus. The locality is at an altitude of 11,000 feet, on the Kiukiang-Salween divide at about latitude 28° N. The same collector later secured one at Gomba-la, on the Mekong-Salween divide. Nothing further is known of it, but undoubtedly it will eventually prove to be at most a slightly larger subspecies of *N. gracilis*, of which it is obviously a close relative. The luck of collecting appears again in this case where Forrest secured six specimens, while Andrews and Heller working in the same general area secured numbers of *Rhynchonax* instead.

From the brief notes entered on the labels of the original series, it appears that all were trapped on open alpine meadows at altitudes of from 11,000–14,000 feet, except one which was caught in *Abies* forest at a similar height. It is thus apparently a high-alpine species.

Specimens examined:—In all, eight, namely:

Yunnan: Salween-Kiukiang divide, 7 (B.M.); Mekong-Salween divide, 1 (B.M.).

Genus **Scaptonyx** Milne-Edwards

Scaptonyx Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 278, pl. 38B, fig. 4; pl. 40B, fig. 2, 1868-74.

This is a somewhat more mole-like member of the Uropsilinæ than *Uropsilus*, with a long cartilaginous snout, slightly broadened hands with large, nearly straight claws, of which the first and fifth are much shorter than the three middle ones. There is practically no external ear and the tail is shorter and more thickened than in that genus, thinly clad with stiff short hairs that do not conceal the rings of scales. It resembles the Japanese *Urotrichus* and the western American *Neurotrichus*, to both of which it is related. In the skeleton, Milne-Edwards has shown that the terminal

phalanges of the hands are bifid as in the moles, and the humerus lacks the entepicondylar perforation for the brachial nerve.

In the skull the zygomatic arches are complete though slender and thread-like, and the tooth formula has one lower incisor on each side less than the full placental number. The interpretation of the lower teeth was tentatively published by Milne-Edwards as three incisors, a canine, three premolars and three molars, but Thomas (1912b) has shown that it is really one of the incisors (the anteriormost) that is missing, so that the tooth formula is: i. $\frac{3}{2}$ c. $\frac{1}{1}$ pm. $\frac{4}{4}$ m. $\frac{3}{3}$ = 42. The first upper incisor of each side is the largest, and the two are set with their chisel-like edges transverse to the tooth row; the two succeeding upper incisors are smaller, the canine conical, and relatively small, about as high as the first incisor; it is followed by three small, conical, double-rooted premolars, and a fourth much larger consisting of a high triangular cusp and a small inner lobe. In the lower jaw the two anterior incisors on each side are small, chisel-like and project slightly forward, the canine is very small, while the first premolar as in the true moles is enlarged and conical, with a minute posterior cusp at the base. The two small premolars behind it are similar but smaller, and double-rooted.

So far as known the genus is confined to the Chinese highlands.

This interesting genus, as Milne-Edwards says, looks like a mole with the feet of *Urotrichus*, or like a *Urotrichus* with the head of a mole. It gives the annectant stage between the more shrew-like moles, as represented by *Uropsilus*, and the more typical genera, adapted for a wholly subterranean life. The presence of this genus isolated in the highlands of western China is another instance of the persistence here of a primitive type, while its additional interest lies in the fact that it is represented on the Pacific coast of North America by a related but more progressive genus, *Neurotrichus*, and in Japan by *Urotrichus*. Only one species is known, with one subspecies.

16. **Scaptonyx fusicaudatus** Milne-Edwards

Scaptonyx fusicaudatus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 278, pl. 38B, fig. 4; pl. 40B, fig. 2, 1868-74.

Scaptonyx fusicauda David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 92, 1871 (*lapsus calami*).

Type specimen:—The type was a specimen sent by Père Armand David who secured it "sur les confins du Kokonoor et du Sé-tschouan." Unfortunately, the flask in which it was preserved in alcohol was broken in transit to France, so that the specimen arrived in very poor condition, and the skull was so injured that Milne-Edwards found it possible to figure the teeth only. The specimen is still preserved in the Muséum d'Histoire Naturelle at Paris.

Description:—The general form is mole-like, with the fore feet only slightly broadened, but with stout flattened fossorial claws, the hind feet more

slender, with long, compressed claws, the backs of both hands and feet covered with scales between which are short scattered black hairs. Fur soft, short and mole-like, of a uniform dark slate color throughout. The tail is hardly twice the length of the hind foot, thickened, and slightly tapering from the enlargement near the base (fusiform), thinly and evenly clad with long projecting blackish hairs.

The skull is lightly built, with slender and complete zygomata, the snout tapering to a blunt point. The teeth have been briefly described under the generic characters.

Measurements:—The type specimen measured: total length, 108 mm.; tail, 45. No skull measurements of the typical form are available.

Occurrence and Habits:—The type is the only recorded specimen.

Specimens examined:—None.

17. **Scaptonyx fusicaudatus affinis** Thomas

Scaptonyx fusicaudatus affinis Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 514, 1912.

Type specimen:—A male, skin and skull, No. 12.3.18.1, British Museum, from twelve miles south of Atuntze, northwestern Yunnan, at 13,500 feet altitude. Collected June 22, 1911, by F. Kingdon Ward.

Description:—Similar to the typical form, but the upper canine slightly smaller, and with other minute differences in the teeth, as follows: third upper premolar not larger than second incisor; first and second upper premolars subequal, and smaller than the third; fourth upper premolar slightly shorter horizontally but of about the same breadth as the third; lower tooth row shortened, the incisors less spatulate; canine (the third tooth in the jaw) shorter and more slender than the posterior incisor; first and fourth lower premolars nearly equal in size but "rather lighter" than in the typical form, but the second and third lower premolars conspicuously smaller, the latter not a quarter the bulk and only about half the height of the fourth; the second lower incisor again about one-half its bulk and three-quarters its height, both the second and third single-rooted (Thomas, 1912b, p. 514).

Measurements:—The following dimensions are available from specimens in the British Museum, and others taken by Edmund Heller of the fresh specimens collected by the American Museum Asiatic Expeditions:

No.	Head and body	Tail	Hind foot	Ear	Sex
12.3.18.1 BM (type)	90	31	15.5	3.5	♂
44517	88	26	15.0	—	♂
44518	—	—	—	—	♂
44519	—	—	—	—	♂
22.9.1.12 BM	80	29	12.0	—	—

CRANIAL MEASUREMENTS OF *SCAPTONYX*

No.	Greatest length	Basal length	Palatal length	Zygomatic breadth	Breadth of brain case	Breadth outside molars	Upper tooth row	Lower tooth row	Locality
12.3.18.1 BM	24.3	20.2	11.0	8.6	10.7	6.8	10.5	9.1	Yunnan
44517	24.0	19.4	10.5	8.5	——	6.7	10.5	9.8	Yunnan
44518	——	——	——	——	——	——	——	——	Yunnan
44519	——	——	——	——	——	——	——	——	Yunnan
22.9.1.12 BM	22.4	18.6	10.0	——	9.9	6.0	10.1	9.3	Yunnan

The skull is extremely slender, with thread-like zygomata, which are less in width than the width of the brain case. The canine and unicuspid premolars of the upper jaw are all double-rooted.

Thomas, who made actual comparison of the skull of the type of *S. fusicaudatus* with that of his specimen from Atuntze, has pointed out the minute differences mentioned above in the proportions of the teeth, and on that basis has regarded the latter animal as a distinct form. It must be said, however, that the characters are of the most trivial nature, and without comparison of more than these two individuals it is difficult to tell how valuable they may be as a basis for subspecific distinction, since there is no way of knowing how great may be the individual variation in the typical form. Of the three specimens secured by the American Museum Asiatic Expeditions, No. 44517 has only three lower premolars, lacking apparently the second, of which there is not even an alveolus.

Occurrence and Habits:—The type specimen of this subspecies, taken some twelve miles south of Atuntze, in northwestern Yunnan in 1912, was the second known example of the genus, and enabled Thomas to correct the impression of Milne-Edwards that the snout was not especially elongated, for it is apparently nearly as attenuate as in *Uropsilus*. Ten years later, Thomas (1922b, p. 393) recorded a second specimen, also a male, secured by George Forrest, on the Mekong-Salween divide, 28° north, at an elevation of 7,000 to 8,000 feet, practically a topotype. The only other specimens known seem to be the three secured by Dr. Andrews and Mr. Heller in 1914, one not far from the original locality, at Tomulang in the Chungtien district, northwestern Yunnan, at 10,000 feet, and two others on the Snow Mountain of the Likiang Range, to the southward, at from 12,000 to 13,000 feet. Probably this is a species of more or less forested country, for Thomas records of his first specimen that it was taken on a mossy bank in a fir forest.

Specimens examined:—Five, as follows:

Yunnan: Tomulang, Chungtien district, 1; Likiang Range, Snow Mountain, 2; Atuntze, 1 (B.M., the type); Mekong valley, 1 (B.M.).

Genus **Talpa** Linnæus

Talpa Linnæus, Syst. Nat., ed. 10, vol. 1, p. 52, 1758.

The typical genus of moles shows a body specialized for subterranean burrowing life, in the pointed head, heavy musculature of neck and arms, the shortened tail, fore feet enlarged and broadened with the palms turned outward, and the five claws stout, flattened and elongate for digging. The short, plush-like fur, lacking a definite grain, is suitable for living in close quarters, and the eye is much reduced in correlation partly with life underground.

The teeth in *Talpa* are of the full number characteristic of placental mammals, with the formula: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{3}{3}$ = 44. The three incisors above and below are subequal, small and with chisel-like edges set nearly transverse to the long axis of the skull; the canines are well differentiated by their size, the upper especially large in contrast to the reduced condition in the Uropsilinæ, and are two-rooted. The three small premolars that follow are of nearly equal size, the fourth considerably larger, while the three molars all show the four primary cusps, of which the two outer form a W with their commissures. The last molar is the smallest, with its inner cusps slightly reduced.

The type species is *Talpa europæa* Linnæus. As a genus this is chiefly found in the temperate portions of Europe and western Asia, as far as the highlands of India, while a single species reaches western China.

18. **Talpa longirostris** Milne-Edwards

Talpa longirostris Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 70, p. 341, 1870; Recherches pour servir à l'Hist. Nat. des Mammifères, p. 281, pl. 17A, fig. 2 (skull and teeth); pl. 38, fig. 2 (exterior), 1868-74.

Type specimen:—No type is indicated in the original description, but the specimen figured and described by Milne-Edwards is presumably still in the Muséum d'Histoire Naturelle at Paris, having been sent by Père Armand David from "Thibet oriental," that is, probably from the mountains of Muping, Szechwan, China.

Description:—This mole is slightly smaller than the European species, with, for a mole, a fairly well-developed tail, terete, with long sparse hairs, the more terminal of which are some 12.5 mm. long. The general color in fresh pelage is slaty black, with a slightly brownish tinge.

The skull has a narrow rostrum, and narrow almost cylindrical interorbital region, from which the wide, oval brain case rather abruptly expands. The upper incisors are subequal, the third slightly the narrowest; the second upper premolar is slightly smaller than the first, and recurved; the third and fourth increase regularly in size, but the fourth has a distinct basal cusp posteriorly.

Measurements:—In addition to the measurements given by Milne-Edwards (1868-74, p. 283) for the type of this species, those of the two in the British Museum are added:

No.	Head and body	Tail	Hind foot	Locality
PARIS (type)	105	20	20.0 (c.u.)	Szechwan
99.3.1.9 BM	—	—	18.5 (c.u.)	Szechwan
11.2.1.24 BM	105	20	14.5 (s.u.)	Szechwan

CRANIAL MEASUREMENTS OF *TALPA LONGIROSTRIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
99.3.1.9 BM	——	——	12.9	——	——	7.1	13.1	12.4	Szechwan
11.2.1.24 BM	32.1	26.8	12.9	9.0	14.5	6.8	12.6	12.0	Szechwan

Milne-Edwards's excellent figures of the skull and dentition leave no doubt that this is a true *Talpa*. In comparison with the European species, however, the upper premolars seem slightly stouter, and the anterior two perhaps single-rooted instead of with two roots, while the large first lower premolar is shown in contact with the lower canine. Milne-Edwards states that there are four lower incisors, but in fact there are only three. The lower canine in side view resembles the incisor next it in its low crown and short cutting edge, but in crown view its base extends much farther inward; the first lower premolar has become caniniform, and of large size, but that it is not the canine is shown by the fact that it lies just behind the upper canine when the jaws are closed.

Occurrence and Habits:—Although said by Milne-Edwards to be apparently "assez commune" in the mountains of Szechwan and eastern Tibet, this continues to be a rare species in collections. It was discovered by Père David in the course of his journey to Szechwan in 1870, whence he sent back the first specimens to the Paris Museum. This area was at that time a borderland included as part of Tibet, but there seems to be no evidence that the species actually occurs in that country as at present understood. No specimens were again reported until 1899, when De Winton and Styan recorded a male secured by the latter at Yunglipa (Yangliupa) in northwestern Szechwan; they describe its color as uniformly black. This specimen remained unique in the British Museum collection until 1911, when Thomas (1911d, p. 163) recorded a second male secured by Malcolm P. Anderson at Omei Shan in the same province. Slightly to the southward the later expedition of the Dresden Museum secured two additional specimens in alcohol, from the isolated Wa Shan Range, the first bought from natives at Wa Shan, the second caught by a dog at Hwanglungtse, in an alpine forest of red-barked birches, among mossy boulders (Jacobi, 1922, p. 2; Weigold, 1923, p. 71).

Anderson's specimen from Omei Shan was caught on a "mossy bank in damp forest," so that the slight available evidence seems to indicate that it is a forest-dweller.

Specimens examined:—Two, namely:
Szechwan: Omei Shan, 1 (B.M.); Yangliupa, 1 (B.M.).

Genus **Parascaptor** Gill

Parascaptor Gill, Bull. U. S. Geol. and Geogr. Surv. Terr., vol. 1 (ser. 2), p. 110, 1875. Type species, *Talpa leucura* Blyth.

This genus is closely similar to *Talpa*, of which by many writers it has been regarded as merely a subgenus, but is well distinguished by the tooth formula, which differs from that of *Talpa* in lacking one of the small upper premolars, making a total of three premolars above instead of the four present in *Talpa*, as follows: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{1}$ m.$\frac{3}{3}$ =42. In external appearance it resembles the common mole, but the tail is very short and club-shaped. Its range includes Assam and Burma, eastward to the borders of Yunnan, and Siam. But the one species is known from eastern Asia, although Milne-Edwards at one time referred to it the mole described from North China by Thomas as *Talpa leptura*, in which the tooth formula was similar, but which, as later pointed out by Thomas (1910), proved on further examination to be really a *Scaptochirus*, with the characteristic broad heavy skull, but abnormally with an extra lower premolar. Milne-Edwards (1884) has also described as *Parascaptor davidianus* a mole said to have been collected by Père Armand David in Syria, but nothing further seems to be known about it.

19. **Parascaptor leucurus** (Blyth)

Talpa leucura Blyth, Journ. Asiatic Soc. Bengal, vol. 19, p. 215, pl. 4, fig. 1, 1850.
Parascaptor leucurus Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 99, p. 1142, 1884.

Type specimen:—The original specimen was from Cherra Punji, Assam, British India, and is presumably in the Indian Museum at Calcutta.

Description:—Similar in general appearance to the common European mole, but the tail very short, club-shaped, about one-twelfth of the total length. Color a uniform brown, varying to black, the basal part of the fur "leaden black"; tail hairs very short, white or whitish.

The skull is of the more delicate type, like that of *Talpa*, with tapering rostrum. The teeth resemble those of the latter, but lack one of the small unicuspid premolars, so that only two of these small teeth intervene between the well-developed upper canine and the large posteriormost premolar. In the lower jaw, the canine in side view is low, with a chisel-like edge, and closely resembles the incisors, while the first premolar as in *Talpa* is enlarged and

caniniform, closing *behind* the upper canine; it is succeeded by two small premolars set close together, while the fourth is large, equaling in size the first.

Measurements:—Blanford gives the following dimensions (here reduced to millimeters) for an alcoholic specimen from India, and I have added those of the Suki specimen:

No.	Head and body	Tail	Hind foot	Locality
14.10.32.2 BM	110	15.5	15	Yunnan
BLANFORD	105	10.0	—	India

CRANIAL MEASUREMENTS OF *PARASCAPTOR*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
14.10.23.2 BM	27.8	24.2	11.7	(9.5)	13.6	7.3	11.5	11.5	Yunnan
22.10.21.1 BM	28.8	24.3	11.6	9.3	14.3	7.3	11.6	11.1	Yunnan

Occurrence and Habits:—Blanford gives the distribution of this mole as Sylhet, the Khasi and Naga Hills, south of Assam, and probably locally throughout Burma, reaching an altitude of as high as 10,000 feet. It is also present in northern Siam, whence it is recorded by Gyldenstolpe (1919) as having been obtained by Eisenhofer southeast of Chiengmai. It is, therefore, not surprising to find it extending into the extreme western border of Yunnan, whence Thomas (1914b, p. 473) has lately recorded the first known Chinese specimen, collected by F. Kingdon Ward at Suki, in the Salween valley, 7,000 feet altitude, in north latitude 27° 30′. There is also in the British Museum a second specimen from Yunnan, taken at Tengyueh, and received in 1922. Ward notes on the label of his specimen that it was captured where there were "numerous burrows in the river bed, amongst grass and shrubs." No other specimens have been taken in China and nothing is recorded of its soil preference or food.

Specimens examined:—In addition to specimens in the British Museum from the Shan States, Khasi Hills, and Assam in British India, two, from Yunnan,—Suki and Tengyueh respectively (B. M.).

Genus **Scaptochirus** Milne-Edwards

Scaptochirus Milne-Edwards, Ann. des Sci. Nat., Zool., ser. 5, vol. 7, p. 375, 1867.
Talpa David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 3, Bull., p. 26, 1867 (not Linnæus, 1758).
Chiroscaptor Heude, Mém. concern. l'Hist. Nat. de l'Emp. Chin., vol. 4, pt. 1, p. 36, pl. 9, figs. 1-1c, 1898.

The moles of this genus differ externally from *Talpa* in the more reduced tail, which is very short and slender (about two-thirds the length of the hind foot), and thinly haired.

The skull is less delicate, with a shorter, broader rostrum, and the molar teeth are larger with higher crowns. In its dentition, *Scaptochirus* has one less premolar both above and below, on account of the loss of one of the small intermediate teeth in each jaw, so that the formula is: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{3}{3}$ =40. The lower canine is in side view like an incisor, while the first lower premolar is enlarged and caniniform.

The type species is *Scaptochirus moschatus* Milne-Edwards, and the genus seems to be confined to eastern China and the borders of southeastern Mongolia. Only a single species is known from this area, with a subspecies of which little is yet made out.

20. **Scaptochirus moschatus moschatus** Milne-Edwards

Scaptochirus moschatus Milne-Edwards, Ann. des Sci. Nat., Zool., ser. 5, vol. 7, p. 375, 1867; Recherches pour servir à l'Hist. Nat. des Mammifères, p. 173, pl. 17, fig. 4; pl. 17A, figs. 1-1c, 1868-74.
Talpa europæa David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 3, Bull., p. 26, 1867 (not of Linnæus, 1758).
Talpa leucura ? Swinhoe, Proc. Zool. Soc. London, 1861, p. 135 (not of Blyth).
Scaptochirus davidianus Swinhoe, *ibid.*, 1870, p. 620 (*errorim*).
Talpa leptura Thomas, Ann. Mag. Nat. Hist., ser. 5, vol. 7, p. 470, 1881.
Parascaptor leptura Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 99, p. 1142, 1884.
Chiroscaptor sinensis Heude, Mém. concern. l'Hist. Nat. de l'Emp. Chin., vol. 4, pt. 1, p. 36, 1898.
Scaptochirus moschiferus Heude, *ibid.*, p. 40, pl. 9, figs. 2-2c (*errorim*).
Scaptochirus leptura Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 5, p. 350, 1910.
Scaptochirus lepturus Thomas, *loc. cit.*

Type specimen:—The original specimen was collected by Père Armand David "en Mongolie" and is presumably still in the collection of the Muséum d'Histoire Naturelle at Paris. In David's time the term Mongolia was used to include what are now the western parts of Hopei and Shansi, so that Thomas has suggested that the type locality may therefore be considered Suanhwafu, about one hundred miles northwest of Peiping, whence much of David's "Mongolian" material came.

Description:—In color this mole is a nearly uniform clear grayish brown above and below, slightly paler about the mouth and on the lower side, glistening silvery in certain lights. The fur is short, with slaty bases and minute brownish tips. The snout is thinly haired, with a lengthwise groove ventrally. The tail is short, about two-thirds the length of the hind foot, with short hairs, hardly hiding the scales, and forming a short terminal tuft. Backs of the broad fore feet and narrower hind feet thinly haired, or in old animals nearly naked.

Measurements:—No fresh measurements of this mole are at hand. Milne-Edwards notes that the head and body of his alcoholic specimen, following the curve of the back, measured 140 mm., and the tail less than a centimeter. The hind foot of the type of *S. leptura* is 20 mm.; its tail, perhaps stretched in the mounted specimen, is 15 mm.

FIG. 4. Distribution Map.

Scaptochirus
1. *S. moschatus moschatus*
2. *S. moschatus gilliesi*

Scapanulus
3. *S. oweni*

CRANIAL MEASUREMENTS OF *SCAPTOCHIRUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
	S. moschatus moschatus								
28.1.6.2 BM	34.2	29.6	14.5	14.7	18.0	10.8	14.3	13.6	Shantung
28.1.6.3 BM	34.3	29.3	14.7	——	17.8	10.7	14.3	14.0	Shantung
28.1.6.4 BM	34.0	28.9	14.2	14.3	18.1	11.1	14.5	13.5	Shantung
8.8.11.15 BM	33.2	——	14.7	——	17.4	10.5	14.4	13.7	Hopei
16.1.1.4 BM	30.7	27.2	13.3	——	17.2	10.1	13.0	——	Hopei
61.6.2.4 BM (type of *T. leptura*)	34.0	——	14.9	——	18.1	10.5	14.6	13.3	Hopei
25883 MCZ	35.7	30.9	15.3	——	17.9	11.1	15.7	14.4	Shantung
	S. moschatus gilliesi								
10.3.13.1 BM	30.2	25.4	12.4	13.3	16.9	9.7	12.5	12.5	Shansi

Nomenclature:—The first specimen of this mole to reach Europe was one sent by Consul Swinhoe to the British Museum in 1860, from Peiping. This, as Swinhoe mentions, was pronounced a new species by Gray, who gave it the manuscript name (on the museum stand) *Talpa chinensis*. This, however, seems never to have been published, so that it remained for Milne-Edwards to study and describe it as a new genus and species in 1867, on the basis of a specimen sent by Père David, probably, as Thomas suggests, from Suanhwafu, about ninety miles northwest of Peiping. Later, in 1870, Swinhoe in his account of Chinese mammals again mentions the species, but inadvertently called it *Scaptochirus davidianus*, a specific name which, curiously, Milne-Edwards gave in 1884 to a mole from Syria. In 1881, Thomas having removed the skull from the original specimen sent by Swinhoe, found that the number of teeth agreed with *Talpa* instead of with *Scaptochirus*, and therefore described the specimen from Peiping as *Talpa leptura*. He later discovered, however, that the lack of the additional tooth characteristic of the genus *Scaptochirus* was evidently an abnormality, for the teeth agreed otherwise; nevertheless he assumed that the Peiping animal might be maintained as distinct on the basis of a longer tail, 15 mm. in the specimen as mounted, but this seems highly improbable, and as the skulls are quite the same, I am regarding *T. leptura* as a synonym of *S. moschatus*.

In 1898, Heude described as a new genus and species, *Chiroscaptor sinensis*, a mole from Hopei which he believed differed from *S. moschatus* (inadvertently written *moschiferus*!) in that the cusps of the lower molars projected much more forward. An examination of his figure and description, however, leaves no doubt that the differences he observed were due to the fact that he compared the fresh, unworn dentition of his type with the much worn teeth of an older individual.

Occurrence and Habits:—Specimens of this mole seem to be uncommon in collections. In addition to the original specimen sent by David to Paris, and assumed to have come from northwest of Peiping, the British Museum has two from the neighborhood of the latter city, and another from Chihfeng, 200 miles to the north. Apparently its range extends farther to the northeast, for A. B. Howell (1929) records a specimen in the U. S. National Museum from Heisui, Manchuria. The only other locality yet reported is Weihsien in Shantung.

Specimens examined:—Nine, as follows:

Hopei: Peiping, 2 (B.M., including type of *Talpa leptura*); Chihfeng, 1 (B.M.).
Shantung: Weihsien, 6 (A.M.N.H., M.C.Z., B.M.).

21. **Scaptochirus moschatus gilliesi** Thomas

Scaptochirus gilliesi Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 5, p. 350, 1910.
Scaptochirus gillesei Sowerby, in Clark and Sowerby, Through Shên-Kan, p. 172, 1912 (*lapsus calami*).

Type specimen:—An adult, skin and skull, No. 10.3.13.1, British Museum, from Hotsin, southwestern Shansi, China. Collected November, 1909, by Robert Gillies.

Description:—Similar to the typical race of Hopei and Shantung, but smaller, with smaller skull, although the tail and foot measurements are nearly identical. The general color of the type may be a slight shade darker, about "broccoli brown."

The skull is markedly smaller with less narrowed middle region, smaller and lighter teeth.

Measurements:—No measurements of total length are available, but the tail is about 16 mm. long; hind foot with claws, 19.5; breadth of fore foot, 12.5. Cranial measurements of the type are given in the table under *S. moschatus*.

Occurrence and Habits:—Moles referred to this slightly smaller race have been taken at several localities in Shansi and Shensi. In addition to the original specimen sent from Hotsin, southwestern Shansi, the American Museum Asiatic Expeditions secured one at Maitaichao, some forty miles east of Paotow; A. B. Howell (1929) records four in the U. S. National Museum from twenty miles west of Ningwufu and a single one from Taiyuanfu, whence also the Museum of Comparative Zoölogy has two specimens collected by F. R. Wulsin; in northwestern Shansi, Sowerby (Clark and Sowerby, 1912, p. 172) mentions its capture on the plains of Wuchai, a dry, sandy area. In Shensi, Sowerby secured it at Yulinfu on the borders of the sandy Ordos Desert, where it was rare and "unexpected." He writes (Sowerby, 1914, p. 59) that this mole "seems to have adapted itself to an existence under more or less desert conditions, in which there certainly cannot be any abundance of worms." Possibly in the absence of these, it finds subsistence in the shape of beetle larvæ, with the adults of which the same author found the desert swarming at certain times of year. Of the two specimens from Taiyuanfu, one taken August 10, 1921, is a young animal with the hair just beginning to grow out, and so short that it hardly projects from the skin. The type specimen in the British Museum is considerably smaller than those from about Peiping, yet is quite adult, with basal suture wholly obliterated.

Specimens examined:—In all, four, as follows:
Shansi: Maitaichao, 1; Taiyuanfu, 2 (M.C.Z.); Hotsin, 1 (B.M., the type).

FIG. 5. Distribution Map.
Mogera

1. *M. latouchei* 2. *M. hainana*

Genus **Mogera** Pomel

Mogera Pomel, Arch. des Sci. Phys. et Nat., vol. 9, p. 247, 1848.

The moles of this genus are characterized by the loss of the lower canine from the dentition, so that the total number of teeth present is one less on each side than in *Talpa*, in which the full number typical of placental mammals, namely 44, is found. The tooth formula is, therefore: i.$\frac{3}{3}$ c.$\frac{1}{0}$ pm.$\frac{4}{4}$ m.$\frac{3}{3}$ = 42. The upper incisors form a slightly convex transverse row; the upper canine is strong and broad, the upper premolars 1-3 are usually double-rooted. In the lower jaw there is a space where the missing canine should be, while the first premolar is large, double-rooted, and functions in place of the canine, although its true homology is evident from the fact that it closes behind the upper canine tooth. Externally the moles of this genus resemble *Talpa* in having the usual form and a short stout tail, well clothed with hair. The range of the genus in general is complementary to that of *Scaptochirus*, for whereas the latter is the mole of northern and northwestern China, the former

is found in the extreme eastern and southeastern part of the country. No doubt there is a difference in soil preference or food, inducing the former to seek the sandy dry areas of the loess formation, while the latter is more coastal, and perhaps is partial to a different type of country. In China this genus is at present known chiefly from the southern portion, extending westward to Szechwan, and eastward through Formosa and the Japanese islands into Korea and Manchuria, but apparently avoiding altogether the provinces of North China. The type species is the Japanese *Talpa* (=*Mogera*) *wogura* Temminck.

22. **Mogera latouchei** Thomas

LA TOUCHE'S MOLE

Mogera latouchei Thomas, Proc. Zool. Soc. London, 1907, p. 463.
Talpa sp., Swinhoe, Proc. Zool. Soc. London, 1870, p. 620.
Talpa wogura Thomas, Proc. Zool. Soc. London, 1898, p. 771 (not of Temminck).
Mogera mogera Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 3, 1930.

Type specimen:—The type is a skin and skull, No. 98.8.17.1, British Museum, from Kuatun, northwestern Fukien, China. J. D. La Touche, collector, 1898.

Description:—A small mole, of a nearly uniform slate color, faintly washed above with dark brown; below more smoky, the throat and upper chest paler, dark gray. Backs of the hands and feet and the tail thinly clad with dull whitish hairs, those on the tail longer. The tail is slightly longer than the hind foot.

The skull is smaller as compared with that of the more northern forms, and is specially characterized by having the first upper premolar single-rooted and usually shorter than the second.

Measurements:—The following measurements of the exterior were made by the collector, Mr. Clifford H. Pope, of a series from Chunganhsien:

No.	Head and body	Tail	Hind foot	Sex
——	110	15	14.0	♀
84805	93	19	14.0	♂
84806	108	18	14.0	♂
84808	106	14	14.0	♂
84809	87	16	13.5	♂
84810	95	20	14.0	♂
84811	115	19	14.0	—

CRANIAL MEASUREMENTS OF *MOGERA*

No.	Greatest length	Basal length	Palatal length	Greatest width	Across molars	Upper tooth row	Lower tooth row	Locality
			M. latouchei					
84805	29.0	25.0	12.0	14.0	7.7	12.0	11.5	Fukien
84809	27.7	24.0	11.5	13.0	7.0	11.5	11.0	Fukien
84811	28.5	24.0	11.7	13.5	6.8	11.6	——	Fukien
84808	29.5	25.0	12.0	15.0	7.0	11.8	11.0	Fukien
96.8.17.1 BM	28.8	24.0	11.6	13.9	7.2	11.6	10.8	Fukien
			M. hainana					
10.4.25.4 BM	30.0	——	12.0	14.3	7.6	11.7	11.2	Hainan

Occurrence and Habits:—The occurrence of a mole in southern China seems first to have been recorded by Robert Swinhoe (1870c, p. 620), who secured one from Foochow, Fukien. It was next obtained in the northwestern part of the same province by J. D. La Touche and C. B. Rickett, who secured six (four skins and two in alcohol) at Kuatun, where it was found to be "tolerably common" in the hill country. One of these specimens subsequently became the type of this species. In addition, Cabrera (1922, p. 163) has recorded it also from Foochow, and the American Museum of Natural Nistory has specimens from Fuching and from Shaowu on the Min River in the same province, as well as a series from Chunganhsien, northwestern Fukien, practically topotypes, secured by Mr. Clifford H. Pope, who writes that it is common there in the high mountains. At Kuatun, he says, the Chinese know it as "fan pa chang" (reversed palm) and "pu chien t'ien" (not see heaven, *i. e.*, blind). Westward from Fukien, it is found sparingly, having been recorded from the southwestern border of Hunan (Shih, 1930b, p. 2) and still farther south, from the Yao Shan district of Kwangsi (Shih, 1930, p. 3); while the most westerly locality known is Tseogiakeo, Szechwan, south of Suifu, on the Yunnan border, whence A. B. Howell (1929, p. 7) records a single specimen in the collection of the U. S. National Museum. Concerning the last, Howell states that it has a broader interpterygoid and smaller bullæ than a specimen from Kuatun, indicating that possibly the more western animal is slightly different, although without a series for comparison, the value of these differences cannot be determined. He adds further that in his specimen from Kuatun the first upper premolar is a trifle longer than the second, instead of shorter; it is slender and recurved.

Specimens examined:—Sixteen, including skins with or without skulls, and a separate skull, namely:

Fukien: Fuchinghsien, 1 skull; Chunganhsien, 8; Shaowu, Min River, 4; Kuatun, 1 (B.M., the type); northwestern Fukien, 2.

23. **Mogera hainana** Thomas

THE HAINAN MOLE

Mogera hainana Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 5, p. 535, 1910.
Mogera insularis hainana Kloss, Journ. Nat. Hist. Soc. Siam, Bangkok, vol. 6, p. 213, 1923.

Type specimen:—The type is an adult female, skin and skull, No. 10.4.25.4, British Museum, from Mount Wuchih, Hainan, China, taken by Alan Owston's collector.

Description:—Larger and browner than *M. latouchei*, the general color of the head and body above, nearly "mummy brown" of Ridgway, slightly more smoky below, and paler grayish about the head above and below. In the specimen at hand, the sides of the muzzle are white. Backs of the hands and feet with scattered short whitish hairs; tail very short, shorter than hind foot, and well covered with short hairs like the back in color. As usual in moles, a silvery sheen appears in certain lights.

The size is intermediate between *M. insularis* of Formosa and *M. latouchei*, both of which agree in having the anterior premolar of the upper jaw smaller than the second and single-rooted, while *M. hainana* agrees with the more northern members of the genus in having that tooth larger than the second and double-rooted.

Measurements:—The following field measurements were made by Mr. Clifford H. Pope:

No.	Head and body	Tail	Hind foot	Locality
59913	120	9	14	Hainan
59914	115	14	17	Hainan
59915	122	10	11	Hainan
59916	125	9	8	Hainan
59917	134	12	18	Hainan

For cranial measurements, see table under *M. latouchei*, page 79.

Occurrence and Habits:—The occurrence of a mole on the island of Hainan was apparently unsuspected by Swinhoe, or by later collectors, until, in 1910, Thomas obtained it from Mount Wuchih through Alan Owston's collectors, and named it *Mogera hainana*. By a curious chance, Kloss (1923), thirteen years later, overlooking Thomas's description, renamed the animal *Mogera insularis hainana*, regarding it as a subspecies of the Formosan animal, *M. insularis*. His specimen also came from Five-finger Mountain (Wuchih). It is apparently local in its distribution and difficult to secure. Mr. Clifford H. Pope tells me that he set traps in many places, and frequently found the little ridges of earth pushed up by the animals, but succeeded in catching only two, although four others were purchased from natives. His trapper

averred that they burrow at a deeper level than the moles of North China (*Scaptochirus*) with which he was familiar.

Specimens examined:—Seven, as follows:
Hainan: Nodoa, 1; Namfong, 5; Mount Wuchih, 1 (B.M., the type.)

Genus **Scapanulus** Thomas

Scapanulus Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 396, 1912.

The special interest of this genus of moles is that it represents in eastern Asia the group to which the moles of North America belong (except of course, the star-nosed mole), namely, the subfamily Scalopodinæ ("Scalopinæ"), in which the incisors become enlarged and the canine of the upper jaw reduced, so that the anterior teeth of the jaw bear the brunt of its forceps-like action. Exteriorly the form is mole-like, but the hands, though more expanded than in *Scaptonyx*, are not quite so wide proportionally as in *Talpa*, etc., while the claws, though long and flattened, are rather slender. The first digit of the hind foot, as first noticed by Thomas, is set outward at a slight angle to the remaining toes, and its claw is stouter and more sharply curved than the others, which are long, slender, and nearly straight. The tail is relatively long, about twice the length of the hind foot, stout and thickly haired. The snout is tapering, fairly long, and grooved on its lower side in the middle.

In the skull, the pterygoids are better developed than in *Scapanus*, and the tympanic bone is incomplete. The interparietal is broad, and less tapering forward than in *Urotrichus*. The tooth formula includes nine teeth above and nine below on each side, a number present elsewhere only in *Neurotrichus*, as follows: i.$\frac{2}{2}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{3}{3}$ = 36. Thomas is confident that it is the third incisor in each jaw and probably the second premolar that are lacking. The lower incisors are proclivous and both abut against the large upper first incisor. Thomas states that the second upper incisor and the first upper premolar are subequal and smaller than the canine that stands spaced between them. In our specimen, however, the second incisor is nearly as large as the canine, and the first premolar is slightly the smallest of all. The third premolar is as high as the canine but more broadly triangular in side view. The upper canine and the two small premolars are all double-rooted. The fourth upper premolar is largest, with a distinct posterior shoulder, but our specimen does not show an internal cusp as did that of the type. The internal ledge-like protocone of the upper molars is faintly three-lobed.

The type and only known species of the genus is *Scapanulus oweni* Thomas.

24. **Scapanulus oweni** Thomas

Scapanulus oweni Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 396, 1912.

Type specimen:—A male, skin and skull, No. 12.8.5.2, British Museum,

from southeast of Taochow, Kansu, China. Collected October 31, 1911, by G. Fenwick Owen.

Description:—General color above and below drab gray, with a silvery appearance in certain lights, very similar to the color of *Blarina*. On close inspection it is seen that the individual hairs are slaty with a minute tip of brown. Area at base of snout slightly paler. Backs of hands and feet thinly haired, their central area colored like the back, the fingers whitish. The stout club-shaped tail is all of twice the length of the hind foot with claw, and so thickly clothed with rather long hairs as to hide the scales; its tip and lower side are slightly paler than the rest, which is colored like the back.

The peculiarities of the skull and teeth have been noted in the generic description.

Measurements:—Thomas published the following dimensions of the type, taken in the flesh: head and body, 108 mm.; tail, 38; hind foot, 14. A specimen in the Museum of Comparative Zoölogy measured: total length, 136 mm.; tail, 38.

SKULL MEASUREMENTS

No.	Greatest length	Basal length	Palatal length	Zygomatic breadth	Breadth of brain case	Breadth across molars	Upper tooth row	Lower tooth row	Locality
BM (type)	28.3	24.5	12.7	9.6	13.0	8.0	12.3	11.5	Kansu
23915 MCZ	27.0	26.5	12.1	10.0	13.2	8.0	11.7	11.0	Kansu

Occurrence and Habits:—As already noted, this mole is an Asiatic representative of the subfamily to which the American moles (except *Condylura*) belong, in which the anterior incisors are enlarged and the canine reduced. It much resembles *Scapanus* or *Parascalops* externally, but is smaller with a longer, well-haired tail. The curious distortion of the first hind toe and its peculiar curved nail were mentioned by Thomas in his original description and are evident in our specimen too. The discovery of this remarkable mole in northwestern China is another of the notable finds in recent years, linking the fauna of eastern Asia with that of America.

Apparently this is a forest-living mole, for G. Fenwick Owen, who collected the two specimens originally recorded, states that they were taken in mossy undergrowth in fir forest. In addition to these, from twenty-three and forty-six miles respectively, southeast of Taochow, in Kansu, only a few other specimens are known, as follows: one from Archuen, Min Shan, in the U. S. National Museum (A. B. Howell, 1929, p. 8), and a second from Choni, in the Museum of Comparative Zoölogy, both localities in southeastern Kansu; a third in the

American Museum of Natural History, collected by Dr. R. C. Andrews, at Taipai Shan, Tsingling Mountains, Shensi, the last extending the known range slightly to the eastward; and a fourth taken in northwestern Szechwan, at Hoangshuikwan, north of Sungpan, July 16, 1931, by the Brooke Dolan Expedition, and now in the collection of the Museum of Comparative Zoölogy.

Specimens examined:—Four, as follows:

Shensi: Taipai Shan, Tsingling Mountains, 1.
Kansu: Choni, 1 (M.C.Z.); southeast of Taochow, 1 (B.M., the type).
Szechwan: Hoangshuikwan, 1 (M.C.Z.).

Family SORICIDÆ

SHREWS

While both the Talpidæ and the Soricidæ are believed to have originated from some common stock, the former have retained the zygomatic arch of the skull and to a large extent an unspecialized dentition, although in some of its members the anterior incisors are slightly enlarged and the canines correspondingly reduced. The genus *Uropsilus*, as the most primitive of living talpids, indicates in general what this common stock may have been like.

The Soricidæ, instead of developing modifications for digging, have retained the lightly built, slender body and limbs, with unenlarged feet and claws, a long tapering head and snout, and a low but evident external ear. The skull is especially characterized by the loss of the zygomatic arches, and the great enlargement of the first incisor of both jaws, together with reduction of the canine, producing a forceps-like modification, foreshadowed in the dentition of *Uropsilus*. The tympanic is a delicate ring of bone, unsolidified to the skull, in contrast to the bulla-like structure in the Talpidæ. A cloaca is frequently present, again a primitive character.

Two subfamilies are recognized: one, the typical Soricinæ, in which the teeth are red-tipped; the other, the Crocidurinæ, in which the teeth are white. The former is mainly of northern distribution and occurs throughout most of the holarctic region; the latter is confined to the eastern hemisphere and is most abundantly represented in tropical and subtropical areas. In both subfamilies, as parallel modifications, aquatic members have been developed as well as semifossorial forms with reduced tails. In China and Mongolia, the Soricinæ are found throughout the more northern wooded area, southward at higher levels in the western highlands, while the Crocidurinæ are abundant in the southern parts of the area, even at high altitudes, but are few in number of species in northern China and Mongolia.

KEY TO THE GENERA OF CHINESE AND MONGOLIAN SORICIDÆ

A. Teeth with their cusps pigmented dark chestnut..... Subfamily Soricinæ
  a. Tail about as long as head and body or less; upper unicuspids five; large lower incisor with three crenulations on its cutting edge.
    a′. Form slender, ears obvious, claws delicate, tail about half the length of head and body or longer..... *Sorex*
    b′. Form stouter, ears not evident, claws slightly lengthened, tail about half the length of head and body..... *Blarinella*
  b. Tail long, about equaling or exceeding head and body; upper unicuspids less than five; large lower incisor with a single prominent denticle on its cutting edge.
    a′. Upper unicuspids 4..... *Soriculus*
    b′. Upper unicuspids 3..... *Chodsigoa*
B. Teeth white, their cusps unpigmented..... Subfamily Crocidurinæ
  a. Tail at least half as long as head and body.
    a′. Ears prominent, projecting well above fur; tail with longer scattered bristles, especially on its basal half.
      a″. Upper unicuspids 4..... *Suncus*
      b″. Upper unicuspids 3..... *Crocidura*
    b′. Ears reduced, not projecting; aquatic, with fringes of short stiff hairs on sides of feet and toes.
      a″. Feet not webbed, tail cylindrical..... *Chimarrogale*
      b″. Feet webbed to base of third joint; tail with vertical and lateral crests..... *Nectogale*
  b. Tail very short, not exceeding hind foot in length; ears much reduced; upper unicuspids 2 only..... *Anourosorex*

In addition to these genera it can hardly be doubted that the genus *Neomys*, an aquatic group of the Soricinæ, will eventually be found in the northern part of Mongolia, for it occurs over much of continental Europe and the British Isles, eastward into northern Asia, and has recently been recorded from the shores of Lake Baikal, at no very great distance to the north of the Mongolian border (Ognev, Annuaire Mus. Zool. Acad. Sci. de Russie for 1917-21, vol. 22, p. 346, 1921).

Genus **Sorex** Linnæus

Sorex Linnæus, Syst. Nat., ed. 10, vol. 1, p. 53, 1758.

The members of this genus include some of the smallest living mammals. The limbs and feet are delicately formed, all four feet with five toes well developed, the first shorter, and all provided with sharp compressed claws. The snout is elongate and tapering, the vibrissæ long, and the tail slender and thinly haired, about as long as the body.

The skull is low and broad, of delicate structure, the brain case relatively large, the rostrum pointed and narrow. The first upper incisor is much en-

larged with two cusps one behind the other, the posterior cusp equaling in side view the two succeeding unicuspid conical incisors; the canine resembles these incisors in shape but is smaller, and is followed by two small premolars of which the second is much smaller than the first, and stands in the angle between the first and the much larger third premolar (p^4), which is somewhat molariform with a well-developed antero-internal cusp. The molars exhibit the primitive structure, with a well-marked W-pattern formed by the two outer cusps (paracone and metacone) and their commissures, and a large inner cusp (protocone) with a postero-internal ledge (hypocone) produced distinctly backward. In the lower jaw the first incisor is also enlarged, long and scalpriform, with its long axis in the direction of the tooth row and its upper cutting edge provided with three serrations; it is followed by two smaller teeth, triangular in side view, which are interpreted as a canine and a premolar. The lower molars are three in number, so that the tooth formula is: $i.\frac{3}{1}$ $c.\frac{1}{1}$ $pm.\frac{3}{1}$ $m.\frac{3}{3} = 32$.

This genus is of holarctic distribution in forested areas of the northern parts of Asia, Europe and North America. Several species occur in China and the wooded parts of Mongolia. In general they are of a nearly uniform brownish color above, paler below; one group, however, has a narrow black median stripe. Type species, *Sorex araneus* Linnæus.

KEY TO THE CHINESE AND MONGOLIAN SPECIES OF *Sorex*

A. Back a uniform shade of brown without black median stripe.
  a. Larger, hind foot with claws 13-14 mm.
    a′. Lower surfaces whitish-tipped.
      a″. Tail about 40 mm..... *Sorex araneus borealis*
      b″. Tail about 50 mm..... *S. excelsus*
    b′. Lower surfaces distinctly brownish..... *S. sinalis*
  b. Smaller, hind foot with claws 12 mm. or less.
    a′. Skull length about 18 mm.
      a″. Browner..... *S. buxtoni buxtoni*
      b″. Grayer..... *S. buxtoni cansulus*
    b′. Skull length about 15 mm..... *S. minutus thibetanus*

B. Back with a blackish median stripe.
  a. Dark brown above.
    a′. Larger, skull length 17.5-18.0 mm..... *S. cylindricauda cylindricauda*
    b′. Smaller, skull length 16.6 mm..... *S. cylindricauda gomphus*
  b. Paler, grayish brown above..... *S. cylindricauda wardi*

25. **Sorex araneus borealis** Kastschenko

Sorex araneus borealis Kastschenko, [Synopsis Mammals Western Siberia and Turkestan], Rec. Tomsk Univ., p. 85, 1905 (in Russian).

Type specimen:—No type or type locality is designated according to Hollister (1913c, p. 510), who has consulted the original publication in which

the name was given; the description is based largely, however, on "specimens collected by Middendorff in the 'far north'," and the range includes northern Siberia and the mountain ranges from the Altai eastward.

Description:—Central area of head, shoulders and back a distinct cinnamon brown (about Prout's brown of Ridgway), the sides of head and body lighter, with a tinge of ochraceous. An indistinct line marks off the color of the back from that of the sides. Lower surface of body, whitish or pale gray, with a slight buffy wash, the fur everywhere with dark gray bases. Backs of hands and feet dull brownish like the back, with silvery reflection in certain lights. Tail indistinctly bicolor, like the back above, paler, about like the belly below, with a short terminal pencil.

Skull apparently not different from that of the European *S. araneus*, delicate and tapering. The first upper incisor is large, its anterior cusp in side view nearly half as high again as the second cusp, which in turn is about the same size as the two unicuspid teeth next following. After these, the two succeeding unicuspids are distinctly smaller, the third smaller than the second and the fourth slightly smaller again. The minute fifth unicuspid is in the tooth row and well visible in lateral view. The large anterior lower incisor has three well-marked cusps on its upper edge, the first of which is the largest, the others successively smaller. The second lower incisor has a minute but distinct posterior cusp, while the next tooth has a much larger projection on its posterior edge. The tips of all the cusps are broadly colored reddish brown.

Measurements:—No external measurements of Mongolian specimens are available, but two from the Altai were measured by Hollister, as follows: head and body, 67, 67; tail, 31, 40; hind foot, 12.5, 12.5.

SKULL MEASUREMENTS OF *SOREX ARANEUS BOREALIS*

No.	Greatest length	Basal length	Palatal length	Breadth of brain case	Breadth across molars	Upper tooth row	Lower tooth row	Locality
45588	20.4	17.5	8.5	9.0	5.5	8.5	6.8	Mongolia
45589	——	——	8.8	——	5.0	9.0	8.2	Mongolia
14373 MCZ	18.0	15.2	7.5	9.0	4.8	7.5	7.1	Siberia

Additional measurements of Altai specimens are given by Hollister (1913c, p. 510), who regards this as "very like true *araneus*" but averaging "somewhat smaller than any European form" of that species except the Spanish *S. a. granarius.*

Occurrence and Habits:—This is a representative of the common shrew of Europe and differs very little from it in color and general appearance. It is widespread in the northern parts of Europe and Asia, and may be recognized by its distinctly cinnamon-brown coloring with usually a well-defined contrast

between the dark coloring of the back and the more ochraceous tint of the sides of the body. It is perhaps represented in America by the similarly colored *Sorex arcticus*, also a northern species in its general dispersal. This is apparently a forest-loving animal and was found by the American Museum Asiatic Expeditions along the southern edge of the larch woods on the northern border of the Gobi, at localities fifteen and forty-five miles northeast of Urga, Mongolia, and again to the westward, where, at Sainnoin Khan, the southern edge of this wooded area was also investigated, at an altitude of 8,000 feet. Thomas (1912b, p. 392) has recorded the capture of two on the northern border of Mongolia, in the Syansk Mountains, one hundred miles west of Lake Baikal, Siberia. There seems to be no evidence of its presence in North China.

Specimens examined:—Ten, as follows:

Mongolia: Fifteen miles north of Urga, 1; forty-five miles north of Urga, 8; Sainnoin Khan, 1.

26. **Sorex excelsus** G. M. Allen

Sorex excelsus G. M. Allen, Amer. Mus. Novitates, no. 100, p. 4, December 28, 1923.

Type specimen:—Adult male, skin and skull, No. 44359, American Museum of Natural History, from the summit of Ho Shan, Peitai, thirty miles south of Chungtien, western Yunnan, China, altitude 13,000 feet. Collected November 29, 1916, by Dr. R. C. Andrews and Mr. Edmund Heller.

Description:—A medium-sized shrew of a general grayish brown above, near Prout's brown, slightly grayer on the head and faintly darker on lower back; grayish below with a faint buffy tinge, and a silvery appearance in some lights. Tail indistinctly bicolor, like the back above, paler below with a short terminal pencil of hairs. Backs of hands and feet silvery gray.

The skull shows no special peculiarities except for its long slender rostrum. The teeth in general recall those of *S. araneus*, to which this may be related. The anterior two unicuspids are nearly equal; the third is very slightly smaller in side view, about equaling the large posterior cusp of the first incisor. The fourth unicuspid is again slightly smaller than the third, while the fifth is very small, but completely visible in side view; in crown view its area is about the same as that of the tooth in front of it. The large lower incisor has three well-marked cusps on its upper edge. All the teeth have their tips heavily pigmented.

Measurements:—The collector's measurements of the type and two topotypes are as follows:

No.	Head and body	Tail	Hind foot
44357	62	50	14.0
44358	60	50	13.5
44359 (type)	60	51	13.0

The skull of the type measures: greatest length, 18.7 mm.; basal length, 16.2; palatal length, 8.5; breadth of brain case, 8.6; breadth outside last molars, 4.6; upper tooth row, 8.2; mandible, 10.2; lower tooth row, 7.8; depth of brain case, 5.1.

Occurrence and Habits:—Three specimens of this shrew from the summit of Ho Shan, Peitai, thirty miles south of Chungtien in western Yunnan, were secured by Dr. Andrews and Heller in late November, 1917, and appear to be the only known specimens. They constitute the most southern record in China for a *Sorex* of the plain-backed type, for the other members of the genus known from Yunnan are of the striped-backed group. The relationship of the species seems to be with the *S. araneus* division, hence it is not surprising that it should be found at this alpine height, as a southern representative of this group. It is large, and long-tailed as compared with *S. araneus*, and is of very uniform grayish brown, quite without the tricolor effect of the latter, with its well-marked dark back, buffy sides, and pale belly.

Specimens examined:—Three, including the type, from Ho Shan, thirty miles south of Chungtien, Yunnan.

27. **Sorex sinalis** Thomas

Sorex sinalis Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 398, 1912.

Type specimen:—An adult male, No. 12.8.5.3, British Museum, from forty-five miles southeast of Fengsiangfu, Shensi, China. Collected August 10, 1911, by Dr. J. A. C. Smith.

Description:—A large, uniformly brown shrew, of a general grayish brown above, under surface drab brown; hands and feet brownish white. Tail long, brown above, paler below, the tip slightly penciled.

The skull is of the usual appearance in the genus, but correspondingly large, with a long muzzle.

Measurements:—The type measured: head and body, 70 mm.; tail, 55; hind foot, 14.

Its skull measured: condylo-incisive length, 21 mm.; condylobasal length, 20.3; greatest breadth, 9.6; upper tooth row, 9.1; breadth across molars, 4.8. A skull from Kansu, No. 84002, A.M.N.H., measures: greatest length, 21 mm.; basal length, 19; palatal length, 10; upper tooth row, 9; lower tooth row, 9.

Occurrence and Habits:—This is a large and very brown-looking species with a long tail, quite different from any other Chinese shrew. It is known from the type locality (whence the collector secured eight specimens), some forty-five miles southeast of Fengsiangfu, Shensi, and from southern

Kansu, where the same collector took one at a point seventeen miles southeast of Taochow. The American Museum also has a specimen taken probably in southeastern Kansu.

Specimens examined:—One, from southeastern Kansu.

28. **Sorex buxtoni buxtoni** J. A. Allen

Sorex buxtoni J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 19, p. 181, 1903.
Sorex centralis Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 8, p. 758, 1911.

Type specimen:—An adult female, skin and skull, No. 18655, American Museum of Natural History, from Gichiga, west coast of Okhotsk Sea, Siberia. Collected July 27, 1901, by N. G. Buxton.

Description:—In summer pelage, light reddish brown above, minutely dusted with gray; sides slightly more buffy. Below from chin to base of tail, the fur is everywhere slaty at the base, tipped with whitish and faintly suffused over the chest and belly with pale yellowish. Feet silvery white. The tail is evenly brown like the back above, and silvery white below, with a terminal pencil that is dark brown all around.

In winter pelage, the central area of the back is slightly darker reddish brown, with less of the gray dusting, the sides from the level of the eye and base of the ear, and rather high up on the edge of the shoulder, are contrastingly buffy, with a rather sharp line of demarcation setting off the mid-dorsal area, which is itself about twice the width of the buffy lateral band. Feet and under side of tail silvery white, the latter clear dark brown above, and penciled. The ventral surface of the head and body is white-tipped, with a faint yellowish suffusion.

Measurements:—The rather short tail and small delicately formed hind foot are distinctive features, and the Mongolian specimens do not differ in their dimensions from the Siberian individuals which I have seen. The following measurements were taken in the flesh by the collector:

No.	Head and body	Tail	Hind foot	Ear	Locality
45595	65	30	12	8	Mongolia
57225	64	35	13	7	Mongolia
59939	68	35	12	7	Mongolia

CRANIAL MEASUREMENTS OF *SOREX BUXTONI*

No.	Greatest length	Basal length	Palatal length	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
45596	18.2	16.3	8.5	8.5	4.4	8.1	7.6	Mongolia
57225	18.2	16.3	8.1	8.9	4.3	7.5	6.8	Mongolia
18637	18.6	16.2	8.0	8.6	4.3	7.9	7.0	Siberia
15294 MCZ	18.1	15.5	8.0	8.4	3.8	7.6	6.6	Siberia
15295 MCZ	17.8	15.8	7.7	8.2	4.1	7.4	6.8	Siberia

There is more or less individual variation in the proportionate sizes of the upper unicuspid teeth. In some specimens the two anterior are very nearly equal in size, and the two posterior, though notably smaller, are also subequal, while the fifth is very small and stands in the tooth row, wholly visible in side view; in others the proportions are more as in the *minutus* group, of which this species is doubtless a member, the first unicuspid of each pair slightly but clearly larger than the second.

Nomenclature:—Mr. G. G. Goodwin of the American Museum of Natural History has called my attention to the desirability of comparing the shrews of northern Mongolia, which I had in part referred to *S. centralis*, with the animal described earlier by Dr. J. A. Allen from Gichiga, eastern Siberia, and after a minute examination of topotypes of this latter and a comparison with others that are from very near the type locality of *S. centralis*—the Syansk Mountains—I fail to see any difference that could be deemed worthy of recognition by a separate name. There can be no doubt, I think, that *S. centralis* is a synonym of *S. buxtoni*, and that this species is in turn hardly distinguishable if at all from the Korean *S. annexus*, of which, however, I have seen no specimens. Possibly in a final review, *buxtoni* will prove to be an eastern race of *S. minutus*, to which it is evidently closely allied.

Occurrence and Habits:—This is another of the northern forest-dwelling species that follow the limit of the trees along the northern edge of the Gobi, for in the course of his trapping, Dr. Andrews found it in small numbers at localities fifteen and forty-five miles northeast of Urga and at Sainnoin Khan farther to the westward. Doubtless it extends its range northward toward tree limit, and eastward to the Pacific Ocean. The shrew of Kolyma, Siberia, which I described as *Sorex araneus ultimus*, should, it now appears, be regarded as at most a subspecies of *S. buxtoni*, from which it differs chiefly in its slightly darker color and long winter coat. Compared with the large-footed and darker *S. araneus borealis*, this species is at once distinguishable by its smaller and more delicate hind foot of a silvery white.

Specimens examined:—In all, fourteen, as follows:

Mongolia: Fifteen miles north of Urga, 4; forty-five miles northeast of Urga, 8; Sainnoin Khan, 2.

29. **Sorex buxtoni cansulus** Thomas

Sorex cansulus Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 398, 1912.

Type specimen:—A female, skin and skull, No. 12.8.5.13, British Museum, from forty-six miles southeast of Taochow, Kansu, China. Collected September 23, 1911, by Dr. J. A. C. Smith.

Description:—A small grayish-brown shrew, of the *S. annexus* style, in which the teeth resemble those of *S. minutus*.

Above grayish brown, sides tinged with buffy, but no definite tricolor pattern present as in *S. araneus*. Below drab, or broccoli brown; hands and feet brownish white. Tail dark brown above, lighter below.

The skull is said to resemble that of *S. annexus* of Korea, but with a less elongated muzzle than that of *S. centralis* from the Syansk Mountains, Siberia. In *S. annexus*, one of the *S. minutus* group, the teeth differ from those of the *S. araneus* group in having the posterior cusp of the large first incisor higher, nearly as high as the anterior cusp, while the second unicuspid is smaller than the first and the third is again higher, nearly equaling the first.

The above description is taken from Thomas's account of the type specimen. He regards this as a form connecting the Korean *S. annexus* with the longer-muzzled form *S. centralis* which he described from the northern border of the Gobi, in the Syansk Mountains, but here considered a synonym of *S. buxtoni*. Apparently it differs from *S. annexus* of Korea chiefly in its paler, grayer color, so that it is hardly very different from *S. buxtoni* but is for the present retained as a subspecies. It is one of the *S. minutus* group, in which the first upper unicuspid tooth is larger than the second instead of practically equal to it in size.

Measurements:—The dimensions of the type are given as: head and body, 64 mm.; tail, 38; hind foot, 12.

Its skull measured: condylo-incisive length, 19.2 mm.; condylobasal length, 18.1; greatest breadth, 9; upper tooth row, 8; across molars, 4.6; front of first incisor to front of large upper premolar (p^4), 3.7; front of p^4 to back of m^2, 4.

Occurrence and Habits:—Thomas records three specimens, two from the type locality forty-six miles southeast of Taochow, Kansu, and a third from fifteen miles southeast of the same city. It is evidently uncommon in this region, and its distribution may be limited by the presence of suitable forest growth. From its relative, typical *S. buxtoni* to the north, it is apparently separated by the intervening stretches of the Gobi.

Specimens examined:—None.

30. **Sorex minutus thibetanus** Kastschenko

Sorex minutus subsp. *thibetanus* Kastschenko, [Synopsis Mammals Western Siberia and Turkestan], Rec. Tomsk Univ., p. 93, 1905 (in Russian). Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, p. 251, 1932.

Type specimen:—The type specimen is presumably at the Tomsk Museum, Siberia, and came from Tsaidam, Chinghai.

Description:—No details of the color are available, but probably it is similar to the typical form, with the "upper parts between sepia and wood-brown in summer, more nearly hair-brown in winter, the hairs . . . with faint silvery sub-terminal annulations . . . giving rise to" a slightly grayish effect (Miller, 1912); below "smoke gray," feet brownish with a silvery tinge, tail like the back above, paler beneath. The color pattern lacks the contrasted buffy sides of the *S. araneus* group.

The teeth of typical *S. minutus*, as described and figured by Miller, are characterized by their small size, and by the gradation in the shape of the unicuspids of the upper jaw, the first, second and third nearly equal, with the second usually slightly smaller than the third, and the fourth somewhat smaller still, while the fifth is about as large as the fourth or smaller.

Measurements:—The only known Chinese specimen is recorded by Osgood (1932), who gives the following measurements: total length, 80 mm.; tail, 33; hind foot, 11.

Skull: greatest length, 15.1; width of brain case, 6.5; upper tooth row, 6.5.

Occurrence and Habits:—Osgood (1932) records "a single tiny shrew obtained by Jack Young," ten miles north of Muli, Szechwan, and brought back by the Kelley-Roosevelts Expedition, which "may be assigned provisionally to this form." It is apparently the first record of the *S. minutus* group from China, although its occurrence was to be expected, since it ranges across Siberia.

Specimens examined:—None.

31. **Sorex cylindricauda cylindricauda** Milne-Edwards

STRIPED-BACKED SHREW

Sorex cylindricauda Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 260, pl. 38A, figs. 3-3d; pl. 38B, fig. 3, 1868-74.

Sorex bedfordiæ Thomas, Abstract Proc. Zool. Soc. London, February 14, 1911, p. 3; Proc. Zool. Soc. London, 1911, p. 164. Omei Shan, Szechwan.

Sorex wardi fumeolus Thomas, Abstract Proc. Zool. Soc. London, October 31, 1911, p. 49; Proc. Zool. Soc. London, 1912, p. 132. Weichow, sixty miles northwest of Chengtu, Szechwan.

Sorex bedfordiæ bedfordiæ Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 8, 1929.

Type specimen:—No type is specified. The original specimen is presumably still in the Paris Museum, where it was examined by Thomas. It was collected in Muping, Szechwan, by Père Armand David about 1870.

Description:—A small shrew, with long slender tail about the length of head and body or slightly less. The upper surfaces of the body are a dull cinnamon brown with, however, an ill-defined dark stripe down the back

about 4 mm. wide on the skin. The color of the upper side passes gradually into that of the ventral surfaces, which are dark gray slightly washed with cinnamon brown. The backs of the feet are pale brownish, and the tail is distinctly bicolor, rather darker above and at the tip all around than the dark portion of the back; silvery below except at the tip. In winter the pelage is grayer, the lower side with but little tinge of brownish.

The skull appears to be very much like that of *S. araneus*, but minutely narrower across brain case and palate, with therefore a more tapering appearance. The first upper incisor has the anterior cusp shorter, while the unicuspids following are less obviously in pairs according to size, but instead the first three are of almost the same height and extent in side view, with the fourth obviously much smaller, and the fifth unicuspid well visible, standing full in the tooth row and larger in proportion than in *S. araneus*, in which it is partly hidden and squeezed in between the large premolar and the fourth unicuspid.

This is a small brownish shrew with a dark area forming a blackish stripe some 4 millimeters or so wide down the middle of the back from between the shoulders, while the brownish hue of the back is (at least in summer specimens) continued as a wash over the lower surfaces, partly covering the gray of the basal portion of the hairs. The skull is characterized by its delicate and tapering form, narrower across the tooth rows than in *S. araneus*, with the three first unicuspids all of about equal size in profile, the fourth considerably smaller, and the fifth, in other species usually minute, here larger than usual, sometimes nearly equaling the fourth, with a crown area of about the size of that of the fourth, and the tooth itself standing fully in the tooth row instead of being partly hidden and drawn into the angle between the fourth unicuspid and the large premolar. There is evidently much variation in the intensity and definition of the dorsal blackish stripe: sometimes it is more diffuse and forms merely a darkened band, ill defined, from shoulders to tail, or again it is sharper and more intensely blackish. In the type specimen, the stripe was apparently obscure, a condition no doubt heightened by the fact of its having been skinned out after immersion in spirit, as suggested by Thomas (1911d, p. 164), who examined it at Paris. In Milne-Edwards's colored figure the stripe is not evident. Thomas (1911d) nevertheless concluded that specimens taken at Omei Shan in central Szechwan, "conspicuously marked with a deep black line running down the center of the back," should be referred to this species, indicating the extreme of variation in the development of this character. In the same locality were taken other shrews of this type with "an indistinct dorsal stripe" which sometimes was "only discernible as a faint darker median wash often broken over the shoulders." These shrews Thomas regards as a different species, differing only in the usually less well-marked stripe and decidedly smaller size. The dimensions he gives, however (head and body, 55

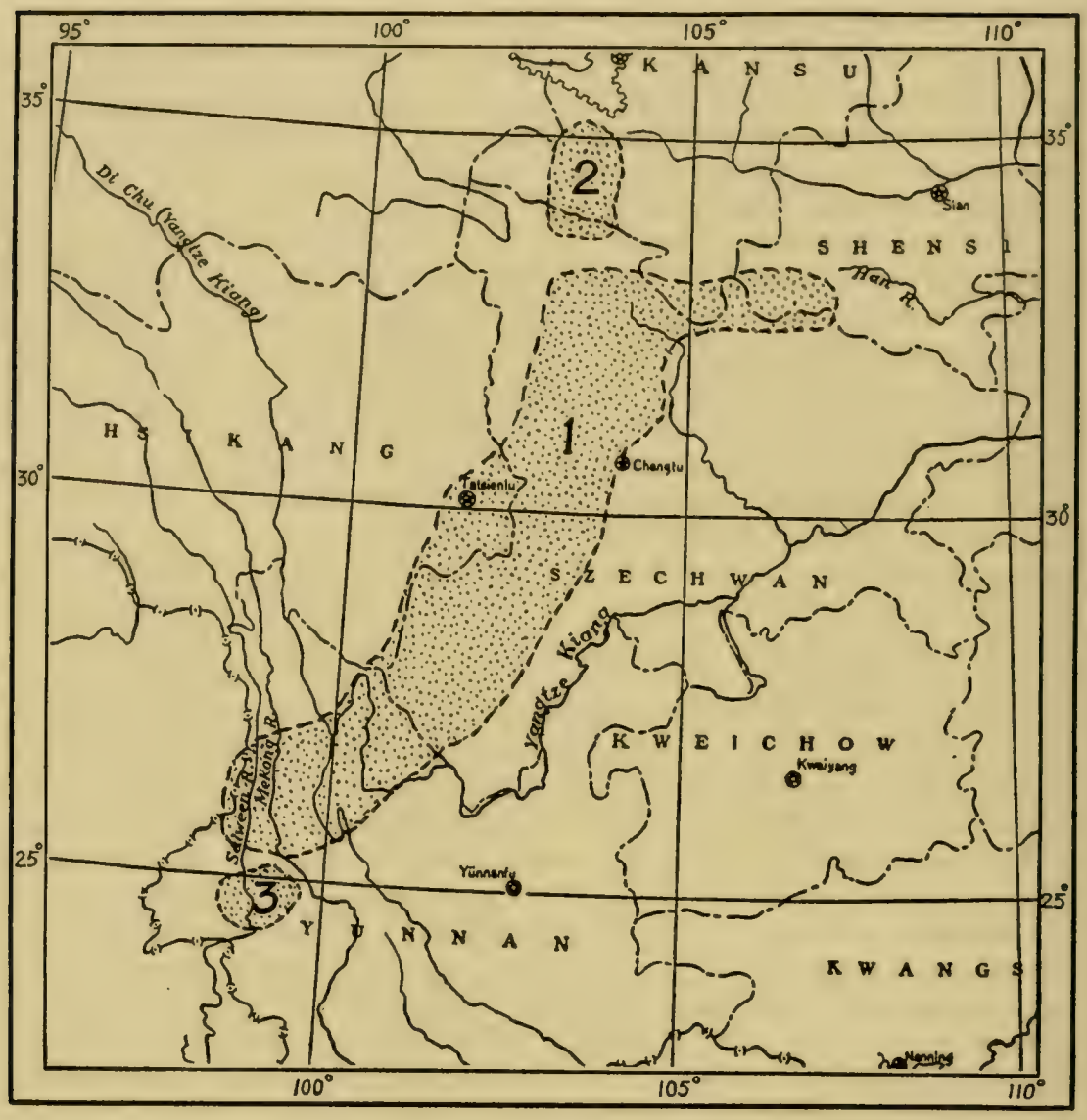

FIG. 6. Distribution Map.
Sorex

1. *S. cylindricauda cylindricauda*
2. *S. cylindricauda wardi*
3. *S. cylindricauda gomphus*

mm.; tail, 55; hind foot, 13; skull length, 17.4), are almost precisely those of the type specimen. After much consideration, I have concluded that *S. bedfordiæ* is, therefore, a synonym of *S. cylindricauda*, and that the two other striped-backed shrews described by Thomas, *Sorex wardi* and *S. wardi fumeolus*, are conspecific with it, their grayer coloring probably due in part to their being winter specimens. The former is from Kansu, the latter from a point

only a few miles north of Muping, whence the type of *S. cylindricauda* was obtained. *Sorex wardi* was described on the basis of a single specimen only, and according to Thomas differs mainly in smaller size, grayer color and more flattened brain case. In the last character, *S. w. fumeolus* is said to be similar, but as Merriam long ago pointed out, "old and young skulls of the same species [of *Sorex*] from the same locality differ surprisingly in size, form and massiveness. With increasing age the cranium as a whole becomes broader, shorter, and flatter . . . the brain case and palate broaden measurably and the arch of the brain case falls away." Until further and more conclusive evidence of the specific distinctness of these supposed species can be brought forward, it may be better to regard them all as a single species with one or two not very clearly marked races.

As with shrews of this genus generally, there is a certain amount of individual variation in the relative sizes of the minute unicuspid teeth. While usually the first three are of nearly uniform size in profile, one specimen examined had the second distinctly smaller than the first and third. Occasionally the fifth, which in this species is better developed than usual, may exceed the fourth in side view, and it is normally quite as large as the fourth in crown view.

Measurements:—The following measurements of the original specimen are given by its describer: head and body, 54 mm.; total length, 112; tail, 58; hind foot, 12.5; length of cranium, 17.5. Field measurements of two from Likiang taken by the American Museum Asiatic Expeditions are: head and body, 60, 55 mm.; tail, 50, 52; hind foot, 12, 12.

SKULL MEASUREMENTS OF *SOREX CYLINDRICAUDA*

No.	Greatest length	Basal length	Palatal length	Greatest width	Across molars	Upper tooth row	Lower tooth row	Locality
			S. cylindricauda cylindricauda					
20739	17.5	14.4	7.3	8.5	4.0	7.0	6.8	Yunnan
20738	18.0	15.0	7.4	8.6	4.0	7.3	6.9	Yunnan
(type of *S.w. fumeolus*)	18.5	18.1	—	8.4	—	8.1	—	Szechwan
(type of *S. bedfordiæ*)	17.4	—	—	8.4	—	7.4	—	Szechwan
			S. cylindricauda wardi					
(type)	17.0	—	—	8.2	—	7.4	—	Kansu
			S. cylindricauda gomphus					
(type)	16.6	—	7.3	8.0	4.4	7.0	6.3	Yunnan

Occurrence and Habits:—Originally described and figured by Milne-Edwards from a specimen secured by Père Armand David in the principality of Muping, central Szechwan, this shrew is probably widely distributed in

the Chinese highlands at higher elevations. The first to be recorded since the original discovery were those obtained by Malcolm P. Anderson for the British Museum, at Omei Shan, only a short distance south of the type locality (Thomas, 1911d, p. 164). Later, another was recorded by Thomas (1912e, p. 132) from Yuenchinghsien, a part of the same humid range in which Mt. Omei lies. To the north, if *S. wardi fumeolus* be regarded as a large specimen in winter pelage of the same animal, it has been taken at Weichow, about sixty miles northwest of Chengtu, by Anderson, and at Tatsienlu by the Brooke Dolan Expedition, 1931. To the southwestward a considerable extension of the known range is made by the discovery of the species on the isolated Likiang Range in northwestern Yunnan, where Dr. Andrews and Edmund Heller secured eleven on Ssu Shan (Snow Mountain), on the edge of timber-line forest at altitudes of from ten to twelve thousand feet. This series agrees well with the description and figures given by Milne-Edwards. Others were secured slightly to the northward at Hapa, twenty miles north of Taku, 10,000 feet; at Tomulang, Chungtien district, 10,000 feet; and at Peitaiping, on the Mekong drainage, 9,000 feet. Thomas (1911d, 1914b, 1922b) has further recorded it, under *Sorex bedfordiæ* and *S. wardi fumeolus*, from other localities in the same general areas, as at Omei Shan and Tatsienlu, Szechwan, and from the Mekong valley, and the Mekong-Salween divide, Yunnan, at altitudes of from 12,000 to 14,000 feet, as well as a single specimen from just across the Burma border, on the Kiukiang-Salween divide, latitude 28° north, at 11,000 feet, making its first recorded occurrence in British territory (Thomas, 1922b, p. 394). It is also recorded from Wa Shan, Szechwan, by Howell (1929). To the eastward, another considerable extension of the known range is its discovery by Dr. Andrews, in Shensi, in the Tsingling Mountains, where on Taipai Shan, two were captured at an altitude again of 10,000 feet.

In southern Kansu the same species occurs, but is possibly subspecifically distinct, and is the animal named *Sorex wardi* by Thomas (1911d), while in extreme southwestern Yunnan occurs the subspecies *S. c. gomphus*.

Specimens examined:—Twenty, as follows:

Shensi: Taipai Shan, Tsingling Range, 10,000 feet, 2.

Yunnan: Peitaiping, Mekong drainage, 9,000 feet, 1; Hapa, twenty miles north of Taku, 10,000 feet, 2; Chungtien district, Tomulang, 3; Likiang Range, 10,000-12,000 feet, 11.

Szechwan: Tatsienlu, 1 (M.C.Z.).

32. **Sorex cylindricauda wardi** Thomas

Sorex wardi Thomas, Abstract Proc. Zool. Soc. London, February 14, 1911, p. 3; Proc. Zool. Soc. London, 1911, p. 165; Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 399, 1912.

Type specimen:—A male, skin and skull, No. 11.2.1.46, British Museum, from ten miles south of Taochow, southern Kansu, China. Collected March 25, 1910, by M. P. Anderson, J. A. C. Smith, and F. Kingdon Ward.

Description:—A striped-backed shrew similar in essential characters to *S. c. cylindricauda*, but apparently slightly paler and with a smaller and lower brain case.

Color, in winter pelage, paler than *S. cylindricauda*, nearly "drab" above, the tips of the hairs of the under surface drabby white, markedly contrasting with their slaty bases, and a line of demarcation perceptible on the sides. Dark dorsal streak well marked. Hands, feet and under side of tail sharply bicolor.

The skull of the type has a smaller, lower brain case than in *S. cylindricauda*. The fourth unicuspid is slightly smaller than the three in front of it, which, as usual in this species, are subequal.

Measurements:—The type measured: head and body, 53 mm.; tail, 49; hind foot, 12; ear, 8. The brain case is said to be 4.5 mm. in length against about 5.5 in *S. cylindricauda*.

For cranial measurements of the type see table, page 95.

According to Thomas, its describer, this is distinguishable from its Szechwan ally by the paler color, slightly shorter skull length, and much lower brain case. However, since the type and then unique specimen was in winter pelage, it may be that its apparently paler color is a matter of season, as it is in *S. cylindricauda*, while the smaller size and lower brain case may be characters of immaturity. Nevertheless, it is probable that, as with other mammals, the slightly different conditions in Kansu have been sufficient to produce a certain amount of geographic variation, so that probably *wardi* should be retained as a subspecies of *S. cylindricauda*.

Occurrence and Habits:—The type specimen of this form, taken ten miles south of Taochow in southern Kansu, was at the time the only example known, but in the following year, 1911, Mr. G. Fenwick Owen, visiting the same region, brought back eight others, which were taken and prepared by Dr. J. A. C. Smith of his party, who had accompanied the previous expedition of Anderson. These specimens were from localities forty-two, forty-six, and thirty miles southeast of Taochow, at altitudes of from 9,000 to 10,000 feet. Evidently, as elsewhere, this is a high-altitude shrew. Thomas, in recording the additional specimens (1912d, p. 399), does not give any further particulars about them, implying that they agree with the type in the characters claimed.

Specimens examined:—None.

33. **Sorex cylindricauda gomphus** G. M. Allen

Sorex bedfordiæ gomphus G. M. Allen, Amer. Mus. Novitates, no. 100, p. 3, December 28, 1923.

Type specimen:—A male, skin and skull, No. 44320, American Museum of Natural History, from Mucheng, Salween drainage, western Yunnan,

7,000 feet altitude. Collected February 11, 1917, by Dr. R. C. Andrews and Edmund Heller.

Description:—A smaller, darker-brown shrew than the typical form. General color above, a rich dark cinnamon-brown, near Mars brown of Ridgway, but clouded. A narrow blackish stripe runs from the nape to the base of the tail, not sharply defined but merging gradually with the color of the back. Below, the chest and belly are gray washed with cinnamon brown, but the throat is clearer gray, with a silvery sheen. Backs of feet, and the tail all around, clothed with minute dark hairs of about the same cinnamon-brown as the body.

The skull is slightly smaller than in typical *S. cylindricauda*, but the general relations of the teeth are similar, with the three anterior unicuspids of about equal size in side view, the fourth, however, smaller and less than the fifth instead of exceeding it, a condition which is apparently found occasionally in the other forms of the species. In crown area, however, the fifth tooth exceeds the fourth.

Measurements:—The type measured in the flesh: head and body, 55 mm.; tail, 39; hind foot, 13.

For skull measurements of this specimen see the table, page 95.

Occurrence and Habits:—This form was described from a single specimen, so that its validity may be questionable, but since it was from so low an altitude as 7,000 feet, in the southwestern part of Yunnan, where conditions are somewhat different from those of central Szechwan and northern Yunnan, it is likely that its small size and rich coloring even in a winter skin are significant as subspecific characters.

Specimens examined:—

Yunnan: Mucheng, 1.

Genus **Soriculus** Blyth

Soriculus Blyth, Journ. Asiatic Soc. Bengal, vol. 23, p. 733, 1854.

This genus of shrews is distinguished from *Sorex* by its relatively longer tail, and by the reduction of the tooth formula through the loss of one of the upper unicuspid teeth, a premolar, so that the dentition consists of the following: $i.\frac{3}{1}$ $c.\frac{1}{1}$ $p.\frac{2}{1}$ $m.\frac{3}{3} = 30$. The first upper incisor has a large basal cusp, and is followed by three subequal unicuspids, which are two incisors and the upper canine. The first premolar is an exceedingly minute tooth, not visible from the exterior, but crowded in between the canine and large premolar, which are in contact and quite shut it off from the tooth row. In the lower jaw the first incisor is long, proclivous, and extends back beneath the two smaller teeth succeeding it. It has on its upper cutting edge only one low hump-like cusp instead of the three present usually in *Sorex*. The second tooth, the

canine, is unicuspidate, but the next tooth, the premolar, has a well-marked posterior cusp, in addition to the main cusp. The tips of the cusps of all the teeth are pigmented dark chestnut. The type species is *Corsira nigrescens* Gray (=*Soriculus nigrescens*), an Indian species. Three species occur in the mountains of British India, and the genus is represented by nearly allied forms of apparently two species in the highlands of western China.

KEY TO CHINESE SPECIES OF *Soriculus*

A. Tail longer than head and body, about one and one-half times..... *S. macrurus*

B. Tail shorter than head and body.

a. Larger, hind foot 14 mm., tail bicolor..... *S. caudatus sacratus*

b. Smaller, hind foot 12 mm., tail dark all around..... *S. c. umbrinus*

34. **Soriculus macrurus** Blanford

Soriculus macrurus Blanford, Fauna British India, Mammalia, p. 231, 1888. Wroughton, Journ. Bombay Nat. Hist. Soc., vol. 24, p. 481, 1916.

Sorex macrurus Hodgson, in Gray, Cat. Mamm. Nepal and Thibet, ed. 2, no. 91, p. 9, 1863 (*nomen nudum*).

Soriculus irene Thomas, Abstract Proc. Zool. Soc. London, October 31, 1911, p. 49; Proc. Zool. Soc. London, 1912, p. 132. Yuanchinghsien, southwestern Szechwan.

Type specimen:—Wroughton (Journ. Bombay Nat. Hist. Soc., vol. 24, p. 481, 1916) has shown that *Sorex macrurus*, commonly attributed to Hodgson, is a *nomen nudum* in the "Catalogue of the Specimens and Drawings of Mammals, Birds, Reptiles and Fishes of Nepal and Thibet," edition 2, 1863. No diagnosis is given and no plate or drawing is specifically mentioned, although the name is obviously based upon one of the set of original sketches presented to the British Museum by Hodgson. He merely states, however, that his drawing is from a specimen procured close to the house at Darjeeling, India. According to Blanford, whose *Soriculus macrurus* appears to be the first valid name for the animal, Hodgson's original specimen is lost, but he mentions one that he himself secured in the same locality, and gives its measurements and description. This specimen is the actual type of the species, and is apparently in the British Museum. Blanford says that it was in bad condition when found.

Description:—A slender, long-tailed shrew, with a tail-length about one and a half times the length of head and body. General color above in winter pelage a pale gray, slightly darkened, especially in the middle of the back, by an admixture of brown. The sides are a little paler, and their color passes gradually into the clear pale gray of the belly, which has a faint buffy wash. Tail bicolor, pale brownish above, silvery below. Hands and feet whitish, the latter slightly darkened with pale brown on the central metatarsal area. In summer pelage, the color above is slightly darker, the tail less sharply bicolor.

The skull resembles that of *Sorex*, but is less slender, the rostrum not so narrowed and tapering. The first upper incisor is less elongate than in

Sorex, but with a large posterior cusp. In profile, there are three unicuspids following, which form a graduated series, the first largest, the second slightly smaller and the third (the canine) much smaller, about two thirds the height of the first but with nearly the same cross-section. The first premolar is an exceedingly minute tooth, wedged in the angle between the canine and large premolar, and quite hidden from the outside. The enlarged lower anterior incisor, like the upper, is shorter in proportion and less slender than in *Sorex*, and has one large crenulation on its upper cutting edge near the base. The basal portion of this incisor extends back under the next two teeth, nearly to the posterior border of the second. The first of these is unicuspid, the second with a posterior cusplet. The tips of the tooth cusps are pigmented dark chestnut.

Measurements:—Blanford gives the following measurements (here reduced to millimeters) of his Darjeeling specimen: head and body, 53.3 mm.; tail, 86.3; hind foot, 14.3; ear, 7.3; basal length of skull, 15. Two specimens from Hapa and Tugansha respectively, obtained by the American Museum's expedition were measured by the collector as follows: head and body, 56, 58; tail, 83, 81; hind foot, 15, 14.

Nomenclature:—Thomas in 1911, described as *Soriculus irene* a long-tailed shrew from Yuanchinghsien, and recorded others from Mt. Omei on the same range of mountains in Szechwan. They differed chiefly in their apparently lower brain case from the typical *S. macrurus* of India, the type of which Thomas apparently examined. He had previously referred three others from Mt. Omei, in summer pelage, to *Soriculus macrurus*, with the remark that they agree "closely with Blanford's type from Darjiling" (Thomas, 1911d, p. 165). No doubt, however, the color differences observed were merely seasonal and the skull characters due to immaturity or other causes, for in a later paper Thomas (1921a, p. 500) writes: "The variation in the degree of vaulting of the skull makes me now rather doubtful whether *S. irene* of Szechwan should have been separated from *S. macrurus*." I have therefore, on his suggestion, included *S. irene* as a synonym. Osgood (1932) is probably correct in using *Soriculus leucops* Horsfield (who credits the name to Hodgson) in place of *S. macrurus*.

Occurrence and Habits:—Little was known of this beautiful long-tailed shrew beyond the fact of its presence at Darjeeling, India, until it was rediscovered in the highlands of western China by Anderson, who collected a pair at Omei Shan, and later two others on the same range at Yuanchinghsien, Szechwan, at altitudes of 9,500 and 5,200 feet. One of the latter became afterward the type of *S. irene* (Thomas, 1911d, p. 165; 1912e, p. 132). The American Museum Asiatic Expeditions secured a series from various localities

in western Yunnan, at altitudes of from 6,000 to 10,000 feet, as follows: Tomulang, Chungtien district; Tugansha, 20 miles south of Chungtien; Hapa, 20 miles north of Taku; Chunglu (6,000 ft.), Lachumi (9,000 ft.), and Hsiaokela (8,000 ft.) on the Mekong River. In addition to these, taken in November and December, two other specimens, from Mucheng, Salween drainage (7,000 ft.), taken in February, are appreciably darker in color than the others, and may possibly represent a local variation from the extreme southwestern part of this province.

Nothing is recorded of its habits.

Specimens examined:—In all, eight, from the localities in Yunnan listed above.

35. **Soriculus caudatus sacratus** Thomas

Soriculus sacratus Thomas, Abstract Proc. Zool. Soc. London, February 14, 1911, p. 4; Proc. Zool. Soc. London, 1911, p. 165.

Type specimen:—An adult female, skin and skull, No. 11.2.1.54, British Museum, from Omei Shan, Szechwan, China. Collected August 10, 1910, by Malcolm P. Anderson.

Description:—An almost wholly brown species, with tail slightly shorter than head and body. General color above cinnamon brown, minutely dusted with gray, below paler gray, washed with brownish, a little lighter than the back. Tail bicolor, brown above, glossy whitish below. Feet with the central part of metapodial area with scattered brown hairs, the sides and the digits pale.

The skull is slightly larger than that of *S. macrurus*, and with a slightly more slender rostrum in proportion. The teeth are essentially similar also, except that the enlarged upper incisor has a longer and more nearly horizontal main shaft, and the basal cusp is more deeply separated from it. Anteriorly the first incisors are not in contact and are separated by a wider space than in *macrurus*.

Measurements:—This, according to Thomas (1911d, p. 165), is smaller than its other relatives. The type measured: head and body, 60 mm.; tail, 54; hind foot, 14; skull, greatest length (exclusive of incisors), 18.1 mm.; basal length, 15.7; greatest breadth, 9.5; upper tooth row, 8.1.

Occurrence and Habits:—This is the Chinese representative of the Indian *Soriculus caudatus*, which it evidently closely resembles, and from which it undoubtedly is but subspecifically distinct. Although Trouessart in his "Catalogus Mammalium" (1897, p. 186) includes Fukien in its distributional area, I have not found a specific record from that province, so that Thomas's description of this form from Omei Shan constitutes its only known locality. Undoubtedly, however, its range is more or less continuous at higher levels

across western Yunnan into Burma. In extreme southwestern Yunnan, the American Museum Asiatic Expeditions secured a series from Mucheng, on the Salween drainage, which seems to be slightly different and to which I gave the name *S. c. umbrinus*.

Specimens examined:—None.

36. **Soriculus caudatus umbrinus** G. M. Allen

Soriculus caudatus umbrinus G. M. Allen, Amer. Mus. Novitates, no. 100, p. 5, 1923.

Type specimen:—An adult male, skin and skull, No. 44338, American Museum of Natural History, from Mucheng, Salween drainage, southwestern Yunnan, China.

Description:—A small race most like *S. c. sacratus* Thomas of Szechwan, but differing in its darker brown coloring and in having the tail dark all around instead of bicolor. General color above, a uniform seal brown (Ridgway, 1912) instead of the slate gray of *S. c. sacratus;* below, slightly paler brown, nearly Brussels brown, tinged with gray. Backs of the feet and the tail all around light seal brown, like the back.

Skull similar to that of *S. c. sacratus*, hence slightly smaller than that of *caudatus* of Nepal, with specimens of which no comparison has been possible.

Measurements:—The collector's field measurements of the type are: head and body, 60 mm.; tail, 55; hind foot, 12. A second specimen measured 65, 55, and 12 mm. respectively for these three dimensions.

The skull of the type and of a second specimen from the same locality measure, respectively, as follows: greatest length, 18.1, 18.6 mm.; palatal length, 8.1, 8.5; mastoid width, 9.0, 9.1; width outside molars, 5.0, 4.9; upper tooth row, 8.1, 8.2; lower tooth row, 7.3, 7.3.

Occurrence and Habits:—Ten specimens were obtained by the American Museum Asiatic Expedition at Mucheng on the Salween drainage, 7,000 feet, in extreme southwestern Yunnan. These lower-level shrews seem to be slightly darker and with darker tails than the descriptions indicate for the Indian and Szechwan forms to which they are closely related.

Specimens examined:—Ten, from the type locality.

Genus **Chodsigoa** Kastschenko

Chodsigoa Kastschenko, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1905, vol. 10, p. 252, 1907 (as a new subgenus). Thomas, Proc. Zool. Soc. London, 1908, p. 639 (as a genus).
Soriculus De Winton and Styan, Proc. Zool. Soc. London, 1899, p. 574 (in part).

This group of shrews is closely related to *Soriculus*, but has progressed still farther in the evolution of its dentition through the loss of the minute upper premolar which in the latter genus is a mere spicule hidden from sight in profile view in the angle between the third unicuspid and the large premolar.

In addition the large anterior incisor of the upper jaw has as its main cusp a longer and more slender hook, while the basal cusp is proportionately lower and less developed. In the lower jaw, the large proclivous first incisor has a single low, rounded cusplet on its cutting edge, somewhat more poorly developed than in *Soriculus*. The dental formula is: i.$\frac{3}{1}$ c.$\frac{1}{1}$ pm.$\frac{1}{1}$ m.$\frac{3}{3}$ = 28. Externally the two groups are much alike. The skull is characteristically flattened, with a somewhat concave profile. So far as at present known, the genus is confined to the Chinese highlands.

While the differences separating this from *Soriculus* are not very important,

FIG. 7. Distribution Map.
Chodsigoa

1. *C. hypsibia hypsibia*
2. *C. hypsibia larvarum*
3. *C. hypsibia lamula*

so that its species were at first regarded as congeneric with the latter, and then subgenerically different, they seem nevertheless to constitute a small "natural group," for which a generic distinction is convenient. The special interest in the method of tooth reduction which this group illustrates, lies in the fact that after a tooth becomes of very small size as in the minute premolar of *Soriculus*, there comes a stage beyond which its size is not further reduced, but the tooth fails to develop at all, and in transitional conditions is either present or not in individuals of the same species.

The name is based on that of the district, Chodsigou, in northern Szechwan, whence Kastschenko's specimen came. No type species is mentioned, but two new forms were described as belonging to the subgenus, *Soriculus beresowskii* and *S. salenskii*. In view of the fact that the former seems to be a synonym of *Soriculus hypsibius*, the latter species, *Soriculus salenskii*, may be designated as the type.

KEY TO CHINESE SPECIES OF *Chodsigoa*

A. Tail equaling or exceeding combined length of head and body.
   a. Size large, hind foot over 20 mm., tail about 60% of total length..... *C. salenskii*
   b. Size smaller, hind foot less than 20 mm., tail 50-55% of total length.
      a'. Foot larger, about 18 mm., tail about equaling length of head and body *C. smithii*
      b'. Foot smaller, about 17 mm., tail longer than combined head and body *C. s. parca*

B. Tail less than combined length of head and body, about 45% of total length.
   a. Foot larger, about 15 mm..... *C. hypsibia*
   b. Foot smaller, about 11 mm..... *C. parva*

37. **Chodsigoa hypsibia hypsibia** (De Winton and Styan)

Soriculus hypsibius De Winton and Styan, Proc. Zool. Soc. London, 1899, p. 574.
Soriculus (*Chodsigoa*) *beresowskii* Kastschenko, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1905, vol. 10, p. 252, 1907. Chodsigou, northern Szechwan.
Chodsigoa hypsibia Thomas, Proc. Zool. Soc. London, 1908, p. 639; *ibid.*, 1912, p. 133.

Type specimen:—A male, skin and skull, No. 99.3.1.10, British Museum, from Yangliupa, northwestern Szechwan, China.

The type of *Soriculus beresowskii* is a specimen from near the same locality, Chodsigou, northern Szechwan, and is presumably in the Museum of the University at Tomsk, U. S. S. R.

Description:—A long-tailed shrew, with the tail slightly less than the head and body. Upper surfaces of the body gray, washed with brown, producing a general brownish-gray effect, minutely frosted with clearer gray points. Lower surface of the body clear brownish gray, backs of hands and feet contrastingly whitish. Tail indistinctly bicolor, grayish brown above, whitish below. The ears are prominent, nearly naked in appearance, but under a lens seen to be clothed with minute appressed hairs. The winter pelage is slightly grayer than that of summer.

The skull, compared with that of *Soriculus macrurus*, is larger and broader; the anterior incisors are in contact by their inner supplementary cusps; the large premolar of the upper jaw and the first and second molars have their posterior borders much more deeply excavated so that the premolar is almost crescentic in outline. The last upper molar is much narrower, extending transversely as a thin wedge, with the tip external, whereas in *S. macrurus*, this tooth is wider, nearly pear-shaped. A prominent difference is, further, the very sudden narrowing of the rostrum in front of the large premolar. The teeth differ in many minor characters. The large anterior upper incisor has its main cusp more deeply divided, slenderer, with the posterior lobe much lower and less well marked. The first unicuspid is larger than the two following, which are subequal. In the lower jaw, the long first incisor is slightly more hooked at its tip, and has one low rounded basal cusplet instead of the three usually found in *Sorex*. The first lower unicuspid is so crowded between the base of the large incisor and the premolar that its tip points distinctly forward. The premolar has but one cusp.

In profile view the skull is markedly flattened, and the slightly convex brain case meets the horizontal line of the rostrum to form a distinct depressed angle, instead of forming a nearly continuous curve as in *Soriculus*.

Measurements:—No measurements of fresh specimens are available. The type measured in the skin: head and body, 84 mm.; tail, 65; hind foot, 15. The hind foot in other skins measures 15 mm., with claw.

For skull measurements see table, page 112.

Occurrence and Habits:—This gray, long-tailed shrew was first discovered in northwestern Szechwan, China, at Yangliupa in 1899. Again, in 1907, Kastschenko (1907, p. 253) recorded it from a near-by area, Chodsigou, and, believing the animal undescribed, named it *Soriculus* (*Chodsigoa*) *beresowskii*. Thomas (1908f, p. 639; 1912e, p. 133) has pointed out that this is undoubtedly a synonym of *C. hypsibia*, and records two other Szechwan specimens from Weichow, on the Si Ho, in the western part of the province, while to the eastward he makes a wide extension of the known range of the genus by announcing its discovery in Hopei, where in the Eastern Tombs region sixty-five miles east of Peiping, two were trapped in a radish garden on a rocky hillside. These, at first recorded as *C. hypsibia*, were later (Thomas, 1912e, p. 133) described as *C. larvarum*, doubtless only subspecifically different. The typical form is, therefore, to be regarded as confined to the western highlands of China. Its known east and west limits are perhaps indicated by the series collected by Dr. R. C. Andrews's expeditions. He brought back no fewer than twenty-one specimens from the base of Taipai Shan, Tsingling Mountains, Shensi, and a single one, that seems to be undoubtedly the same

animal, from Songpa, Chungtien district, Yunnan, at an elevation of 8,000 feet.

Specimens examined:—Twenty-two, as follows:
Shensi: Taipai Shan, 21.
Yunnan: Songpa, Chungtien district, 1.

38. **Chodsigoa hypsibia larvarum** Thomas

Chodsigoa larvarum Thomas, Abstract Proc. Zool. Soc. London, October 31, 1911, p. 49; Proc. Zool. Soc. London, 1912, p. 133.
Chodsigoa hypsibia Thomas, Proc. Zool. Soc. London, 1908, p. 639.

Type specimen:—An adult female, skin and skull, No. 8.8.7.21, British Museum, from the Eastern Tombs, sixty-five miles east of Peiping, Hopei, China. Collected September 25, 1907, by M. P. Anderson.

Description:—Similar to typical *C. hypsibia*, but the brain case narrower and less flattened.

"Fur close and fine; hairs of back about 3.8 mm. in length. General colour above 'mouse-grey', rather lighter, apparently 'smoke-grey' below. Hands and feet whitish. Tail brown above, dull whitish brown below" (Thomas, 1912e, p. 133).

The skull, though showing the characteristic flattening of the rostrum, is less extreme in this than the more western form, and is said to have a "fairly vaulted" brain case, with the sides not splayed out. The teeth are quite as in typical *C. hypsibia*.

Measurements:—Thomas gives the following measurements of the type: head and body, 68 mm.; tail, 50; hind foot, 14; ear, 8.5.

Skull: length, 19.8 mm.; condylobasal length, 18.8; breadth of brain case, 8.8; height of brain case from basion, 5; upper tooth row, 8.6.

Occurrence and Habits:—This appears to be a very slightly differentiated lowland race of the more western animal, so that I have ventured to regard it merely as a subspecies of the latter. Except for the two specimens taken in a garden near the Eastern Tombs, no others seem to have been recorded.

Specimens examined:—Two, from Eastern Tombs, Hopei (B.M.).

39. **Chodsigoa hypsibia lamula** Thomas

Chodsigoa lamula Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 399, 1912.

Type specimen:—A male, skin and skull, No. 12.8.5.22, British Museum, from forty miles southeast of Taochow, Kansu, China. Collected October 1, 1911, by Dr. J. A. C. Smith.

Description:—Similar to *C. hypsibia hypsibia* but smaller. Fur close, about 3.5 mm. long on the back. General color above mouse gray, scarcely

paler below. Hands and feet white, the latter edged with a slightly darker shade externally. Tail grayish above, glossy whitish below.

Skull slightly smaller than that of *C. hypsibia hypsibia*, its interorbital region even lower and flatter.

Measurements:—The type measured in the flesh: head and body, 67 mm.; tail, 54; hind foot, 13.

Skull measurements, see table, page 112.

Occurrence and Habits:—Thomas described this shrew from a single specimen, picked up on a forest path forty miles southeast of Taochow, Kansu, and the above particulars are taken from his brief account. It seems to differ from the typical form merely in its slightly smaller size.

I have referred to this race a single specimen, No. 24117, in the Museum of Comparative Zoölogy, from Choni, southeastern Kansu, which if not quite typical, may nevertheless be nearer to this race than to *C. hypsibia hypsibia*. In color it is perceptibly browner than specimens of the latter, and the hind foot is slightly smaller, while the cranial measurements are smaller even than in the type (see table). In other respects, as in the general size and proportions of the tail and body, they are closely alike. The collector's measurements are: total length, 127 mm.; tail, 57.

Specimens examined:—One, from Choni, Kansu (M.C.Z.).

40. **Chodsigoa parva** G. M. Allen

Chodsigoa hypsibia parva G. M. Allen, Amer. Mus. Novitates, no. 100, p. 5, December 28, 1923.

Type specimen:—A male, skin and skull, No. 44390, American Museum of Natural History, from Ssushanchang, Likiang Range, western Yunnan, China. Collected October 12, 1916, by Dr. R. C. Andrews and Mr. Edmund Heller.

Description:—Smallest of the known species of the genus, with the general color and proportions of *C. hypsibia*. Dorsal surface of head and body dark brownish gray, on close inspection a dark gray faintly washed with brownish, especially over the lower back, the all-gray hairs showing through to give a minute pepper-and-salt effect. Lower surface clearer gray, faintly washed with brownish. Backs of the feet whitish, the outer sides of the hind feet dusky. Tail brown above, very slightly paler below, its minute hairs not concealing the dark scales.

The skulls of the type series were all badly crushed in the traps, but show, nevertheless, the usual much flattened brain case, and the slight concavity where the rostrum and back of the skull join. The molar teeth do not have their cusps pigmented, but the chestnut coloring is confined to the anterior teeth. Characteristic of the genus, too, is the deep concavity of the hinder

edge of the large premolar and the two large molars, due to the extension backward of the postero-internal angle of the tooth.

Measurements:—The following measurements of the type series were made by the collector in the field:

No.	Head and body	Tail	Hind foot
44390 (type)	54	44	11.5
44391	55	43	11.0
44395	56	45	11.0
44396	55	45	11.0

On account of the damaged condition of the skulls, it is not possible to give full measurements of the type series. The rostrum of the type has a width outside second molars of 4.2 mm. (6.1 in *C. hypsibia*); length of upper tooth row, 6.6; of lower tooth row, 6.1; tip of lower incisor to condyle of jaw, 9.1; to angle of jaw, 9.

Occurrence and Habits:—In describing this shrew, I at first regarded it as a smaller geographic form of *C. hypsibia*, which it resembles in general proportions. Its very much smaller size and the isolated region of Likiang where it is found, induce me now to believe that it is really a quite distinct species. The four original specimens were all from Ssushanchang, at an altitude of 9,000 feet on the Likiang Range in western Yunnan, where it occurs associated with the larger, long-tailed *C. s. parca*.

Specimens examined:—In all, four, the type series, from Likiang, Yunnan.

41. **Chodsigoa salenskii** (Kastschenko)

Soriculus (Chodsigoa) salenskii Kastschenko, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1905, vol. 10, p. 253, 1907.
Chodsigoa salenskii Thomas, Proc. Zool. Soc. London, 1911, p. 166.

Type specimen:—An alcoholic, No. 6388, apparently in the collection of the University at Tomsk, U. S. S. R., from Linganfu, northern Szechwan, China. Collected autumn, 1893, by Berezovski.

Description:—A transcription of the original description (in Russian) is as follows: color of the body and region around the mouth, as well as the feet, as in *C. beresowskii* (= *C. hypsibia*); tail about one and a half times the length of head and body, sharply bicolor, its dorsal side dark brown, below brownish white. Eyes visible but small, somewhat hidden. Ears as in *C. beresowskii*. Mustachial vibrissæ very long, reaching the elbow when the arm is laid forward. Six anterior divided palatal folds. Size and position of the plantar pads as in *C. beresowskii;* as also the coloring of the teeth. Second lower tooth with a very small cusp.

Measurements:—The type measured: head and body, 81 mm.; tail, 116;

hind foot without claws, 20.5; ear, 10 by 10. Length of vibrissæ, 38; claws of hind foot, 3.

Skull, greatest length, 25 mm.; greatest breadth, 10; height of cranium, 6.

Occurrence and Habits:—This is evidently a large species, with a very long tail and long hind foot, characters which seem to separate it readily from the other known members of the genus, all of which are smaller. Nothing further seems to be known of it, and the type specimen still remains unique.

The fact that it has been taken in but one locality, Linganfu, in northern Szechwan, may indicate that its range is mainly west and north of that area, for considerable collecting done in other parts of Szechwan and in Yunnan has revealed none but the smaller species of the genus.

Specimens examined:—None.

42. **Chodsigoa smithii smithii** Thomas

Chodsigoa smithii Thomas, Abstract Proc. Zool. Soc. London, February 14, 1911, p. 4; Proc. Zool. Soc. London, 1911, p. 166.

Type specimen:—A male, skin and skull, No. 11.2.1.537, British Museum, from Tatsienlu, Szechwan, China, 9,000 feet altitude. Collected June 27, 1910, by M. P. Anderson and Dr. J. A. C. Smith.

Description:—A large species, with tail "rather shorter" than or (?) equaling the head and body, hind foot large, 18 mm. The fur fine and soft, in summer the hairs of the back about 3.8 mm. in length. General color a uniform mouse gray above and below, the lower side, however, somewhat more glossy, on account of the different texture of the fur. Hands and feet brownish white or whitish, lighter terminally. Tail pale brown above, whitish below.

Skull much as in *C. hypsibia*, but larger, flattened and heavily ridged; teeth similar, their tips lightly pigmented. First upper unicuspid largest, the two following successively smaller.

Measurements:—The type is said to have measured: head and body, 85 mm.; tail, 68; hind foot, 18. Probably, however, the tail measurement, as given, is too small. At all events, two specimens from Shensi, that I have referred to this species, since they agree in other respects, have the tail obviously long, longer than in *C. hypsibia*, equaling the head and body instead of being shorter. One of these specimens, as measured by Edmund Heller, shows the following dimensions: head and body, 82 mm.; tail, 84; hind foot, 18; ear, 10. Thomas's single specimen may have been unusual in some way.

For cranial measurements see table, page 112.

Occurrence and Habits:—Beyond the single type specimen and a second later obtained at Yulongkong, Szechwan (Osgood, 1932, p. 250), no others appear to have been recorded, in spite of the amount of mammal collecting

that has been done in China. The type was taken at Tatsienlu, central Szechwan (now Hsikang), at an altitude of 9,000 feet in this mountainous, forested country. It is, therefore, of considerable interest that Dr. Andrews secured two examples at Taipai Shan, in the Tsingling Range, southern Shensi, at the high altitude of 10,000 feet. These agree in having the hind foot 18 mm. long, and the skulls accord in measurements with those given for the type, but the tails are as long as the combined head and body, instead of considerably shorter, as in *C. hypsibia*. It seems probable that there may be some mistake in the record of this measurement in the original specimen. The interesting thing is that these two species occur together at this locality, although the present seems much the rarer, to judge from the number secured, twenty-one of *C. hypsibia* and only two of *C. smithii*. Its considerably larger size and proportionally longer tail and hind foot should serve to identify it without trouble.

This shrew is a very uniform gray with a minutely punctate appearance on close examination, on account of the pale tips of some of the hairs or the entirely pale hairs that are scattered throughout the pelage above. The lower surface seems to lack the distinct brownish wash seen in some of the other species.

It was named in honor of Dr. J. A. C. Smith, who accompanied Mr. Malcolm P. Anderson on the journey into western China, and who on this and other expeditions into the interior of that country bore an active share in the collection and preparation of the mammals.

Specimens examined:—Two from Taipai Shan, Tsingling Range, Shensi.

43. **Chodsigoa smithii parca** G. M. Allen

Chodsigoa smithii parca G. M. Allen, Amer. Mus. Novitates, no. 100, p. 6, December 28, 1923.

Type specimen:—A male, skin and skull, No. 44409, American Museum of Natural History, from Homushu Pass, western Yunnan, China, 8,000 feet altitude. Collected April 6, 1917, by Dr. R. C. Andrews and Mr. Edmund Heller.

Description:—A small-bodied, long-tailed species, with the tail considerably more than the head and body, about 55% of the total length, the hind foot about 17 mm.

General color above and below a "dark mouse gray" (Ridgway, 1912), with a faint brownish wash; the color is darkest on the rump, palest on the belly. As in other members of the group, a close examination shows a minute

speckling with pale gray where pale gray hairs or light subterminal rings show through. Tail dusky brown above, scarcely lighter below, clothed with minute dark-brown hairs which do not exceed the scaly rings. Backs of the feet distinctly brownish, their tips whitish.

The skull, though nearly equaling in size that of *C. hypsibia* and much smaller than that of *C. smithii smithii*, is very different from either in having the rostrum relatively shorter and more gradually tapering from brain case to tip instead of being abruptly narrowed in the premaxillary region. The teeth also are smaller and more slender than in either.

Measurements:—The tail is extremely long and slender, considerably longer than in any other described form except *C. salenskii*, in which it is said to be nearly 60% as against 55% of the total length. It is apparently even longer than in the typical *C. smithii*, while the bodily dimensions throughout are smaller, as indicated by the shorter foot.

The collector's measurements of the four specimens secured are:

No.	Head and body	Tail	Hind foot	Locality
44369	—	—	——	Yunnan
44376	—	—	——	Yunnan
44409 (type)	70	91	17.5	Yunnan
44443	66	81	16.0	Yunnan

For cranial measurements see table, page 112.

The relationships of the various forms of this interesting genus are still not altogether clear. Apparently in parts of the range two or three species occur together, distinguished more obviously by differences in size and proportions. The present animal is of small bodily size but with a very long tail, and is possibly to be regarded as a subspecies of the more northern *C. smithii*, which it resembles in its uniform dark gray color, the rather large hind foot, and tail not shorter than head and body. On the other hand, if the original dimensions of the type of *C. smithii* are correctly given, the animal here described is sufficiently different in proportions to be regarded as a distinct species.

Occurrence and Habits:—Four specimens, the type series, were secured in western Yunnan by Dr. R. C. Andrews and Edmund Heller, two on the Likiang Range, at an altitude of 9,000 feet, and two from the Homushu Pass, at 8,000 feet. The species is one of the many interesting discoveries made by the expedition in the high mountain districts of this corner of China. It is peculiar that the genus was not taken by either F. Kingdon Ward or George Forrest, British collectors in the same region at about the same time.

Specimens examined:—Four, the type series, as follows:

Yunnan: Likiang Range, Ssushanchang, 2; Homushu Pass, 2.

SKULL MEASUREMENTS OF *CHODSIGOA*

No.	Greatest length	Basal length	Palatal length	Width of brain case	Width across molars	Upper tooth row	Lower tooth row	Locality
			C. hypsibia hypsibia					
56065	20.2	18.5	9.0	9.3	6.0	8.4	8.0	Shensi
56069	20.0	17.9	8.7	9.0	6.0	8.4	7.5	Shensi
56073	20.4	18.0	9.0	9.4	5.7	8.4	7.7	Shensi
			C. hypsibia larvarum					
(type)	19.8	18.8	—	8.8	—	8.6	—	Hopei
			C. hypsibia lamula					
(type)	18.7	18.0	—	9.0	—	8.0	—	Kansu
24117 MCZ	17.8	16.7	7.5	8.5	5.2	7.6	6.5	Kansu
			C. salenskii					
(type)	25.0	—	—	10.0	—	—	—	Szechwan
			C. smithii smithii					
(type)	22.5	—	—	10.5	—	10.2	—	Szechwan
56087	23.0	21.0	10.0	9.8	6.0	10.0	9.0	Shensi
56088	—	—	—	—	—	—	—	Shensi
			C. smithii parca					
44443	20.5	17.5	8.7	8.8	5.5	8.5	7.8	Yunnan

Genus **Blarinella** Thomas

Blarinella Thomas, Proc. Zool. Soc. London, 1911, p. 166.

Sorex Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 261, pl. 38A, fig. 2; pl. 38B, fig. 2, 1868-74 (in part).

A soricid somewhat modified for burrowing, through the great reduction of the external ear, moderate development of the claws of the fore feet, and the shortening of the tail to about one half of the head-and-body length. The skull is small and rather delicate, tapering in form, without the sudden narrowing of the rostrum seen in *Chodsigoa* or the heavy angular brain case of *Blarina*. The teeth are rather similar to those of *Sorex*, except that the canine (third upper unicuspid) is proportionally much smaller, while the first premolar (fourth upper unicuspid) is exceedingly small and the second about equal to it but so wedged in the angle behind the large posteriormost premolar as to be quite invisible from the outside. The large anterior incisors are like those of *Sorex* and differ from those of *Blarina* in having the posterior cusp well set off from the main cusp instead of being obsolete; the anterior lower incisor has three supplementary cusplets on its upper cutting edge as in *Sorex*, instead of the single low hump in the middle of the edge as in *Blarina*. The upper molars again are much like those of *Sorex* in having the hypocone low and ledge-like, produced behind so that the posterior edge of the two

anterior molars is excavated, whereas in *Blarina* the hypocone is large, about as well developed as the protocone, and broadened so that the posterior border is practically a straight line, and the outline of the crown is nearly square. The tips of the teeth are lightly pigmented. The tooth formula is the same as in *Sorex*, namely: i.$\frac{3}{1}$ c.$\frac{1}{1}$ pm.$\frac{3}{1}$ m.$\frac{3}{3}$ = 32.

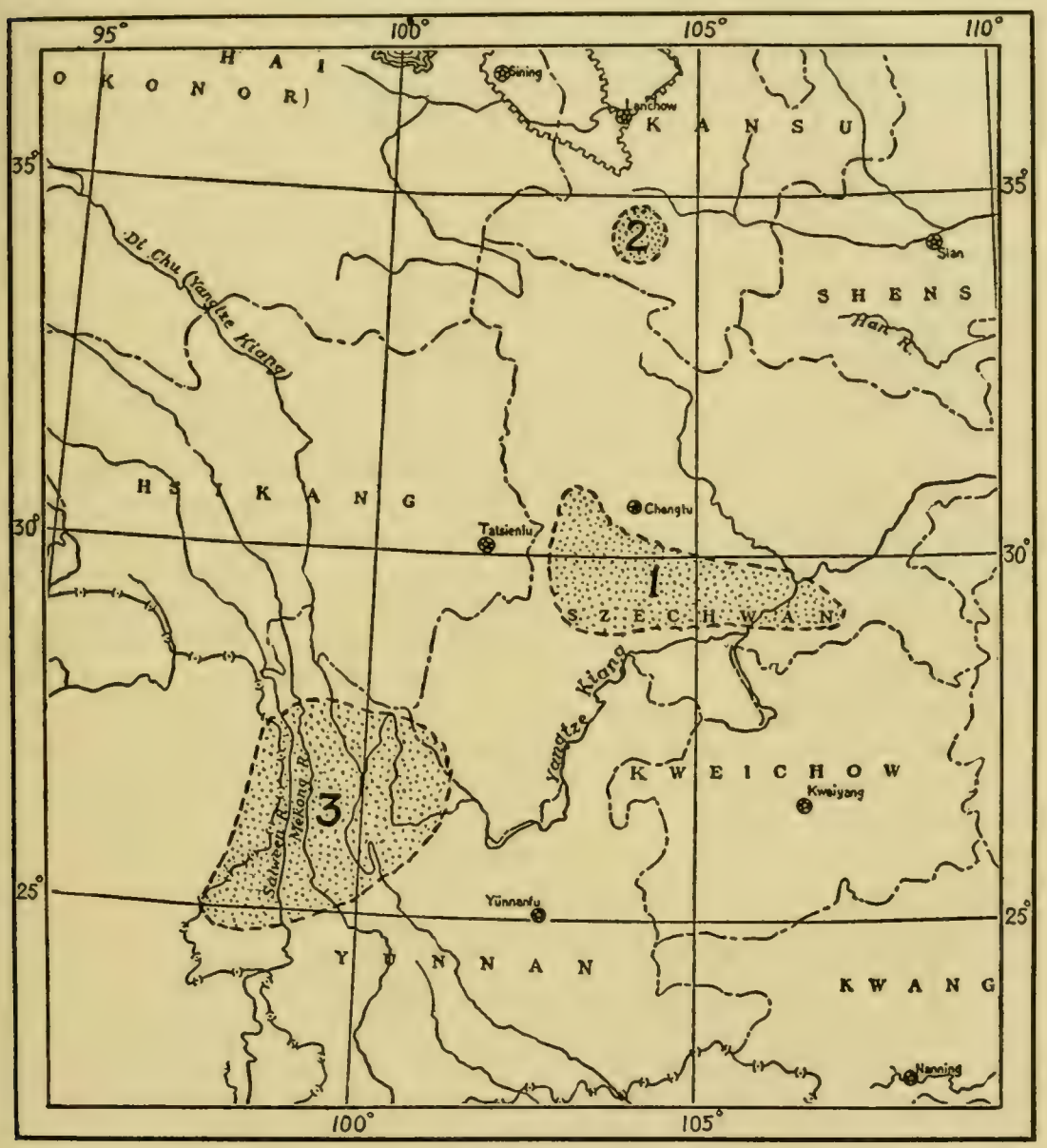

FIG. 8. Distribution Map.
Blarinella

1. *B. quadraticauda quadraticauda*
2. *B. quadraticauda griselda*
3. *B. quadraticauda wardi*

A peculiarity, first noted by Thomas (1915d), and apparently characteristic of this genus, is the reticulated character of the bony wall of the mesopterygoid fossa, visible with a lens.

Notwithstanding Thomas's statement (1911d, p. 166) that this genus is "more allied to the N. American *Blarina* than to any of the Old World genera of shrews" and that it affords a parallel case to that of the jumping mice, *Zapus*, representing this group in the two continents, a careful examination of the teeth induces me to take the opposite view and to regard *Blarinella* as much more closely related to *Sorex* than to the American *Blarina*. In its anterior upper incisors with their large posterior cusp, in the structure of the upper molars with low hypocones, produced backward to form a crescentic hind margin, and in the presence of three cusplets on the cutting edge of the first lower incisor, *Blarinella* much resembles *Sorex*, and equally differs from *Blarina*, which is much more modified, not only in its external form, heavier build, shorter tail, more reduced ears, but also in its heavier, more angular skull, the anterior incisors with the supplementary cusps obsolete, the less-reduced first premolar, and in the greater development of the protocone and hypocone of the two anterior upper molars so as to form a nearly square tooth. On these grounds I should think of *Blarinella* as being a *Sorex*-like type, with the beginnings of fossorial modifications in its exterior form, and with the reduction of the tooth row accomplished by the lessened size of the upper canine and the premolar following. The next stage in this method of reduction is exemplified by *Soriculus* in which the first premolar is lost. *Blarinella* is probably not closely related to any of the American genera of shrews, but a close parallel is perhaps to be found with the American genus *Cryptotis*, in which the minute first premolar is absent.

The type and only species of the genus is that described first by Milne-Edwards as *Sorex quadraticauda*. Two subspecies, fairly well marked, are here recognized.

KEY TO CHINESE RACES OF *Blarinella*

A. Three upper unicuspids visible in side view.
   a. Darker, second unicuspid about equaling the first in side view ..... *B. quadraticauda quadraticauda*
   b. Grayer, second unicuspid intermediate in size between the first and third ..... *B. quadraticauda griselda*

B. Four upper unicuspids visible in side view ..... *B. quadraticauda wardi*

44. **Blarinella quadraticauda quadraticauda** (Milne-Edwards)

Sorex quadraticauda Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 261, pl. 38A, figs. 2-2d; pl. 38B, fig. 2, 1868-74.

Soriculus quadraticauda Dobson, Monogr. Insectivora, pt. 3, pl. 28, figs. 4, 4a, and explanation, 1890.

Blarinella quadraticauda Thomas, Proc. Zool. Soc. London, 1911, p. 166.

Type specimen:—The type specimen was secured by Père Armand David on his expedition into Muping, western China, in 1870, and is still preserved in the Muséum d'Histoire Naturelle at Paris.

Description:—A rather stout-bodied shrew, with external ears extremely short, and a slender tail about half as long as the combined head and body. General color of body above brownish gray, with a silvery reflection in certain lights; below, a clearer gray with a faint suffusion of yellowish brown. Tail with very short hairs, dark brown above, pale below. Backs of hands and feet pale brownish.

The skull is slender and delicate, but heavier than that of a *Sorex*, and with a blunter and less slender rostrum. The characters of the teeth have been sufficiently described under the account of the genus, but in this, the typical form, as Thomas (1911d, p. 167) points out, the first two upper unicuspids are large and subequal, the third is about half their size, in side view, its hinder edge about level with the front edge of the large premolar (p^4), while the fourth is minute, and of about the size of the fifth, both of them crowded in behind the large premolar, and with their crowns compressed in the axis of the tooth row, so that in profile only three unicuspids are to be seen.

In his original description, Milne-Edwards describes and figures only four unicuspids in the upper jaw, but Thomas (1911d, p. 167), after a reëxamination of the type specimen, shows that it "presents the intermediate condition of having on the right side only four unicuspids, the fifth minute one being missing . . . while on the left this tooth is present." Of four other specimens in the British Museum, three have the five unicuspids present on both sides, but the fourth lacks the minute fifth tooth on both sides.

Measurements:—According to Milne-Edwards, the type specimen measured: total length, 103 mm.; tail, 40.

Cranial measurements of the typical race are not available, but probably differ little if any from those of the two races following.

Occurrence and Habits:—So far as at present known, this form of *Blarinella* occurs only in central and eastern Szechwan, China. In addition to the original specimen secured in the principality of Muping, Thomas (1911d) has reported the capture of four at Omei Shan, to the south, at an altitude of 9,500 feet, and (1912e, p. 134) another from southeastern Szechwan, near Nanchwan, at only 4,000 feet. Nothing is recorded of its habits, but presumably it is, like its American counterpart, to some extent a burrower, tunneling in light soil and leaf mould.

Specimens examined:—None.

45. **Blarinella quadraticauda griselda** Thomas

Blarinella griselda Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 400, 1912.

Type specimen:—A female, skin and skull, No. 12.8.5.23, British Museum, from forty-two miles southeast of Taochow, Kansu, China, at 10,000 feet altitude. Collected September 17, 1911, by Dr. J. A. C. Smith.

Description:—Smaller, grayer and shorter-tailed than typical *B. quadraticauda*. General color above, mouse gray; rather paler and more drabby below. Hands, feet and tail dull grayish instead of brown.

Skull slightly smaller than in *B. quadraticauda*. Second upper unicuspid intermediate in size between the first and the third, instead of nearly equaling the first in side view.

Measurements:—The type, as measured by the collector, shows the following: head and body, 68 mm.; tail, 33; hind foot, 11.

The skull measured: condylo-incisive length, 20 mm.; condylobasal length, 18.6; greatest breadth, 9.4; upper tooth row, 8.6; front of p^4 to back of m^2, 4.5.

The above account of the type specimen is from the description of Thomas. The characters claimed may be individual or otherwise within the limits of variation of the typical form, but, since slightly differentiated races of other species seem to take origin under the somewhat different environmental conditions of Kansu, it may well be that this specimen represents a northern race.

Occurrence and Habits:—It was captured "on a mossy bank, in birch-wood." I have referred to this a second specimen in the American Museum of Natural History, from Kansu, without more exact locality.

Specimens examined:—One, from "Kansu."

46. **Blarinella quadraticauda wardi** Thomas

Blarinella wardi Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 15, p. 336, 1915.

Type specimen:—A male, skin and skull, No. 15.2.1.3, British Museum, from Hpimaw, Upper Burma, north latitude 26°, east longitude 98° 35′. Collected August 10, 1914, by F. Kingdon Ward.

Description:—Color dark smoky gray above, very slightly paler below with a faint wash of drab across the chest; tail slightly shorter than in typical *B. quadraticauda*, bicolor, dark gray above, pale below. Backs of hands and feet pale brownish.

In the type the skull is said to be shorter than that of the typical form, and of less breadth, while the first and second unicuspids of the upper jaw are considerably smaller. In his account of *B. quadraticauda*, Thomas (1911d, p. 167) confirms what appears in Milne-Edwards's figure, that in side view only three of the five unicuspids are visible; but in *B. q. wardi*, as represented by Yunnan specimens, four are visible.

Measurements:—The following measurements are from fresh specimens, made in the field:

No.	Head and body	Tail	Hind foot	Ear	Locality
BM (type)	70	35	11.0	4	Burma
44377	66	34	11.5	—	Yunnan
44394	65	36	12.0	—	Yunnan
44400	62	37	12.0	—	Yunnan
44407	70	33	12.0	—	Yunnan

CRANIAL MEASUREMENTS OF *BLARINELLA QUADRATICAUDA WARDI*

No.	Greatest length	Basal length	Palatal length	Greatest breadth	Breadth across molars	Upper tooth row	Lower tooth row	Locality
BM (type)	19.3	18.0	—	8.5	—	8.4	7.7	Upper Burma
44377	19.8	18.0	8.7	8.5	5.1	8.6	7.7	Yunnan
44394	18.8	17.0	8.0	8.5	5.3	8.5	7.5	Yunnan
44400	19.3	17.3	8.7	9.0	5.2	8.5	7.7	Yunnan
44407	19.0	17.5	8.4	8.5	4.8	8.2	7.4	Yunnan

Occurrence and Habits:—This race, which differs from the typical form of Muping chiefly in having the tooth row less compressed, so that four instead of three unicuspids are visible in side view, was first discovered just across the border of western China, at Hpimaw, Upper Burma, at about 26° north, 98° 35′ east, at an altitude of 8,000 feet, so far as known the westernmost limit for this genus. Thomas (1922b, p. 394) later recorded a second specimen from Burma, just across the border of China on the Kiukiang-Salween divide, and at the same time the first Yunnan specimen, from the Mekong-Salween divide, 28° north, at 14,500 feet, both secured by George Forrest in the course of his exploration of southwestern Yunnan. The supposition that the tail in this race is slightly longer than in the typical form does not seem to be borne out by his statement that it measures 35 mm. in length, for Milne-Edwards states that the tail of typical *cylindricauda* is 40 mm. During the course of their work in western Yunnan, Dr. R. C. Andrews and Edmund Heller secured a series of twenty-five specimens, from various localities between Peitai, thirty miles south of Chungtien (10,000 feet), and the Likiang Range, as well as at Hsiaokela (8,000 feet) on the Mekong River, and again at Mucheng, Salween drainage, at only 7,000 feet. Evidently it is not uncommon in proper localities at high altitudes. Curiously enough, all but two of the twenty-five specimens taken were males. The collector's note on the label of one of these states that it was found dead with a beetle in its jaws. Osgood (1932) records a specimen from Nguluko, near Likiang.

Specimens examined:—In all, twenty-five, from the following places:

Yunnan: Peitai, thirty miles south of Chungtien (10,000 feet), 3; Tomulang, Chungtien district (10,000 feet), 1; Hapa, twenty miles south of Taku (10,000 feet), 3; Yinpankai (9,000 feet), 1; Homushu Pass (8,000 feet), 2; Likiang (10,000-12,000 feet), 7; Hsiaokela, Mekong River (8,000 feet), 4; Mucheng, Salween drainage (7,000 feet), 4.

Genus **Suncus** Hemprich and Ehrenberg

Suncus Hemprich and Ehrenberg, Symbolæ Physicæ, 1832, dec. 2, k. Type, *Suncus sacer* = *Sorex crassicaudus* Lichtenstein.

Sorex in part of authors; *Crocidura* in part.

Pachyura De Selys-Longchamps, Etudes de Micromammalogie, 1839, p. 32, as a subgenus of *Crocidura*. Type, *Sorex etruscus* Savi.

It has been shown by Cabrera (Journ. Mammalogy, vol. 5, p. 131, 1924) that the generic term *Pachyura*, long in use first as a subgenus and lately as a genus for the white-toothed shrews having thirty teeth, is after all antedated by *Suncus*, for which the genotype is specifically stated to be the species described by Lichtenstein as *Sorex crassicaudus*. This genus externally resembles *Crocidura* in its shrew-like form, prominent ears, and tapering tail with scattered projecting bristle-like hairs. It may be thought of as representing a less progressive stage in the specialization of the dentition, so that it retains a minute premolar in addition to the large premolar of the upper jaw, making four unicuspids in the upper series. The dental formula is, therefore, one more than in *Crocidura*, namely: $i.\frac{3}{1}$ $c.\frac{1}{1}$ $pm.\frac{2}{1}$ $m.\frac{3}{3} = 30$.

The teeth are white, unpigmented, instead of having the tips chestnut as in the Soricinæ. In general the first upper incisor is large and hook-like, with the posterior cusp not very well marked. The large lower incisor has its upper, cutting edge nearly straight but with a long, low crenulation marking a poorly developed cusp.

The genus is tropical and subtropical in its distribution, in Africa, the Mediterranean region and southern Asia. But a single species, the widely distributed house shrew, occurs in China, and even there is probably in part an introduction.

47. **Suncus murinus** (Linnæus)

? *Sorex murinus* Linnæus, Syst. Nat., ed. 12, vol. 1, p. 74, 1766. Java. Swinhoe, Zoologist, vol. 16, p. 6224, 1858; Proc. Zool. Soc. London, 1870, p. 620.

Sorex myosurus Pallas, Acta Acad. Sci. Imp. Petropol., for 1781, pt. 2, p. 337, 1785. Swinhoe, Proc. Zool. Soc. London, 1870, p. 231.

Sorex swinhoei Blyth, Journ. Asiatic Soc. Bengal, vol. 28, p. 285, 1859; *ibid.*, vol. 29, p. 89, 1860. Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 15, 1922.

Crocidura microtis Peters, Monatsb. Kön. Preuss. Akad. Wiss., Berlin, 1870, p. 589.

Crocidura (*Pachyura*) *murina* J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 481, 1906.

Suncus myosurus A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 9, 1929.

Type specimen:—It is not known if the type specimen is still in existence. Indeed, the applicability of the specific name itself is still in doubt. Linnæus's name, *Sorex murinus*, has long been tacitly supposed to refer to the common musk shrew of southeastern Asia, but the description itself is perhaps indeterminable, as pointed out by Dr. J. A. Allen (1906, p. 481), beyond the fact

that it refers to a shrew of an ashy color, the size of a house mouse, with the tail slightly shorter than the body, and came from Java. It is true that several species of the genus *Crocidura* are known from Java, but the present is a common species there, and the one most likely to be first brought to the attention of European naturalists. Moreover, the brief description applies to it well enough. In a recent collection received from the island, it is the only shrew represented, and that by a series of several specimens. It may then be as well to continue following traditional usage, as Dr. Allen himself did, and as is done in a number of cases where Linnæus's description taken by itself might readily be admitted to be indeterminable. Otherwise, the name *Sorex myosurus* Pallas may be used as A. B. Howell (1929) has done. Probably Peters's *Crocidura microtis* refers to the same species. His specimen came from Hongkong, China, and on account of its size, given as length, 120 mm., tail, 35, may have been youngish, for its foot measurement, 18 mm., and that of the upper tooth row, 13 mm., accord very closely with those of the species here called *Suncus murinus*.

Description:—General color above, including the backs of the hands and feet, and the tail all around, a brownish gray, slightly grayer on the lower surface of the body. The ears are prominent, and nearly naked; the vibrissæ are abundant but not longer than the head, and the tail as usual in this genus and in *Crocidura*, has a number of long bristle-like hairs standing out here and there from the shorter hairs that clothe the tail. There is a prominent gland in the middle of each side, marked by a small area of appressed hairs.

The skull is strong and heavy, with prominent low sagittal crest and sharper, higher lambdoid crests; the anterior end of the brain case projects squarely out, forming nearly a right angle. In side view the large anterior upper incisor has a strong, nearly vertical hook-like main cusp with a well-developed posterior cusp. Following it are four unicuspids, of which the first is largest, then come two of equal size and only about one half as big as the first, while the fourth is much smaller, about a third as big as the two in front of it, and just visible between the third and the large premolar. The two anterior upper molars have the W-pattern well evident, their posterior border slightly excavate. The last upper molar is relatively small, about a third the crown area of the second, with the protocone, paracone and metacone present and three instead of four commissures.

Measurements:—The following measurements are from fresh specimens taken in the field by the collector. The largest specimens seem to be old males which may attain much larger external dimensions than are shown by the females, though the cranial differences are less marked.

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
84784	128	78	14.0	21	♂	Fukien
84786	134	71	14.0	21	♂	Fukien
84787	130	65	14.0	21	♂	Fukien
84789	145	77	14.0	24	♂	Fukien
60246	148	77	12.0	20	♂	Fukien
84778	115	73	12.0	21	♀	Fukien
84785	116	65	13.0	19	♀	Fukien
84781	113	72	14.0	20	♀	Fukien
84790	124	72	14.0	20	♀	Fukien
84791	130	70	13.5	19	♀	Fukien

CRANIAL MEASUREMENTS OF *SUNCUS MURINUS*

No.	Greatest length	Basal length	Palatal length	Greatest width of brain case	Width across molars	Upper tooth row	Lower tooth row	Sex	Locality
84779	31.0	28.6	15.0	13.0	10.0	13.7	12.6	♂	Fukien
84786	32.0	29.4	15.0	13.3	9.8	——	12.0	♂	Fukien
84787	32.0	30.0	15.0	13.2	9.2	13.2	12.3	♂	Fukien
84788	30.5	28.2	14.5	12.0	10.0	13.5	12.0	♂	Fukien
84789	34.0	31.5	16.0	14.0	10.0	14.4	13.0	♂	Fukien
84778	31.3	29.0	15.0	12.3	9.5	13.5	12.8	♀	Fukien
84780	31.0	28.2	15.0	12.0	9.5	13.7	12.5	♀	Fukien
84781	31.5	29.0	15.2	12.7	10.0	14.0	12.8	♀	Fukien
84783	32.0	29.5	15.0	12.0	9.8	13.6	12.5	♀	Fukien
84790	31.0	29.0	14.8	12.7	9.4	13.5	12.3	♀	Fukien

Occurrence and Habits:—So far as available records go, this large shrew is found in the larger towns of South China, coastwise as far north as Fukien, at least. Swinhoe (1870c, p. 620) speaks of it as common in the vicinity of Amoy and other larger towns of southern China, as well as on Hainan where it was abundant in the capital city, and Dr. J. A. Allen (1906, p. 481) also records it there. It is present on Formosa as well as in Japan, but I have no record of its presence on the mainland north of Futsing. Howell (1929) mentions specimens in the U. S. National Museum from the following localities: Fukien Province, Foochow, Futsing, seventy miles southwest of Yenping, and Kulingsu Island near Amoy. Mell (1922) found it abundant about Canton in Kwangtung Province, and expresses his doubt of its occurrence on Hainan. This doubt is, however, at once dispelled by J. A. Allen's record (1909, p. 242) of two specimens from Tingan and Notai on that island. The collectors of the American Museum Asiatic Expeditions secured it at the following localities in Fukien: Foochow, Futsing, Sashin, Yenping, Yuki.

Swinhoe and other authors mention its strong musky odor, which persists even on old dried skins. Swinhoe says that about Amoy it is called "chi-chió" or Money Rat because of the peculiar chatter it keeps up as it runs about, a

noise somewhat like that of jingling cash. Notwithstanding that it is doubtless carried about by junks in the cargo and so has opportunity for occasional colonization, there seems to be little evidence that it has spread much, and is apparently confined to the warmer coast region of South China. Mell (1922) has given an excellent short account of its habits as observed about Canton. He says it is found in the plains, villages and cities of the entire Kwangtung Province, and is the commonest mammal in field and city about Canton; at least it is seen and heard oftener than rats on account of its sharp chirrup constantly given as it runs about. It is especially abundant in swamp or pond areas where dikes are not broken and offer an abundance of holes. It comes freely into the houses, even in the middle of the city of Canton, but is generally absent from woods and thickets. It is a voracious destroyer of ground insects. A captive one that Mell kept for a time ate at a sitting seventeen caterpillars of *Theretra nessus*, weighing in all 153 grams. It cannot or does not climb, but will jump as high as twenty centimeters. It will bite sharply if cornered, and is sometimes killed by cats, but they will not eat it because of its disagreeable odor, which Pocock has supposed to be in a measure protective, or at least warning. Mell supposes it may breed twice in the course of a year, for he twice found nest young, of four in a litter. In Fukien, Mr. Clifford H. Pope assures me that these shrews seem to show no caution, but will walk blindly into a trap day or night, even though the blood of a previous victim be still on it. He found it common about the farm houses.

Specimens examined:—In all, thirty-three, as follows:
Fukien: Futsing, 17; Foochow, 2; Sashin, 5; Yenping, 8; Yuki, 1.

Genus **Crocidura** Wagler

Crocidura Wagler, Oken's Isis, 1832, p. 275.

This genus is externally quite like *Suncus*, with shrew-like form, a stout, tapering tail, with scattered bristle hairs along its entire length, prominent ears and rather short vibrissæ. It is chiefly distinguished by the further reduction of the dentition through the loss of the minute fourth upper unicuspid and the closure of the space between the third unicuspid and the large premolar, giving the following dental formula (as interpreted by Miller): $i.\frac{3}{1}$ $c.\frac{1}{1}$ $pm.\frac{1}{1}$ $m.\frac{3}{3} = 28$.

The genus is largely tropical and subtropical, but a few species extend into temperate Europe and Asia. The type species is *C. leucodon* Hermann of central Europe.

Key to Chinese and Mongolian Species of *Crocidura*

A. Larger, skull length 20 mm. or more, hind foot 14 or over.
  a. Skull length 20-21 mm., hind foot about 14, no white tip to tail *C. attenuata*

b. Skull length 22-24 mm., hind foot about 15-19, tail with a small white tip ..... *C. dracula*
a′. Larger, skull length 23-24 mm. ..... *C. dracula dracula*
b′. Smaller, skull length 21.6 mm. ..... *C. dracula grisescens*

B. Smaller, skull length less than 20 mm., hind foot 12-13 mm.
a. Smaller, color brownish, skull length about 17 mm. ..... *C. ilensis*
a′. Hind feet whitish.
a″. Coloration very pallid ..... *C. ilensis lar*
b″. Coloration dull brownish ..... *C. ilensis shantungensis*
b′. Hind feet dark ..... *C. ilensis phæopus*
b. Larger, color gray, skull length about 19 mm.
a′. Tail about 50 mm., skull length 19, paler ..... *C. vorax*
b′. Tail about 42 mm., skull length 18, darker ..... *C. rapax*

48. **Crocidura attenuata** Milne-Edwards
COMMON GRAY SHREW

Crocidura attenuata Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 263, pl. 38B, fig. 1; pl. 39A, fig. 2, 1868-74.
Crocidura grisea A. B. Howell, Proc. Biol. Soc. Washington, vol. 39, p. 137, 1926; seventy-five miles southwest of Yenpingfu, Fukien.
Crocidura attenuata grisea A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 9, 1929.

Type specimen:—The original specimen was collected by Père Armand David, in the principality of Muping, central Szechwan, China, and is presumably still in the Muséum d'Histoire Naturelle at Paris.

Description:—The general color in summer pelage is hardly different from that of *Suncus murinus*, a uniform brownish gray above, and a paler, clearer gray below, faintly tinged with brown. On close inspection, the upper surface appears to be minutely punctate with paler reflections from the grayer portions of the hairs. The backs of the hands and feet are thinly clothed with short pale hairs. Winter skins are paler, more silvery, with longer hair.

The skull is lightly built, less angular than that of the much larger *Suncus murinus*, with low but evident lambdoid crests meeting at the occiput. The sagittal crest is less prominent, a mere ridge. The rostrum is pinched in at the tip and is less tapering than in *Sorex*. The teeth are practically like those corresponding in *Suncus*. The anterior large upper incisor has a prominent posterior cusp and a slender nearly vertical main cusp. The first unicuspid is large, in side view considerably exceeding the posterior cusp of the first incisor, and is about double the height of the subequal second and third unicuspids. There is usually no space between the latter and the premolar. The large lower incisor is without distinct lobes on its cutting edge as typical of the genus. Its base is in contact with the anterior half or two-thirds of the ventral side of the first lower unicuspid.

Measurements:—The following external measurements were taken in the field by the collectors:

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
58301	70	51	14.0	10.0	♀	Szechwan
58302	71	51	13.0	9.0	♀	Szechwan
84801	88	50	13.5	9.5	♀	Fukien
84302	83	50	13.0	6.0	♀	Fukien
84803	89	58	14.0	9.0	♂	Fukien
84804	83	54	15.5	10.0	♂	Fukien
60251	78	53	15.0	9.0	♂	Fukien
56063	70	49	13.0	8.0	♀	Hunan
59919	76	45	13.0	6.0	♀	Hainan
59950A	72	38	13.0	7.0	♀	Hainan

CRANIAL MEASUREMENTS OF *CROCIDURA ATTENUATA*

No.	Greatest length	Basal length	Palatal length	Breadth of brain case	Breadth outside molars	Upper tooth row	Lower tooth row	Locality
44630	20.3	18.5	9.5	9.4	6.5	9.0	8.5	Fukien
84802	20.2	18.2	9.0	9.4	6.5	9.0	8.1	Fukien
7229 MCZ	20.0	18.2	9.3	8.9	6.3	8.9	8.2	Hupeh
56063	20.4	18.6	9.4	9.3	6.7	9.0	8.3	Hunan
56046	20.3	18.3	9.0	9.1	6.1	8.9	7.8	Szechwan
56054	20.0	17.8	9.0	9.0	6.5	9.0	8.0	Szechwan
84011	21.0	18.1	9.9	9.0	6.1	9.2	8.8	China

Occurrence and Habits:—This is a common shrew over all South China at the lower levels, extending its range at least as far north as the mouth of the Yangtze and the adjacent region in Kiangsi. Thence it is found westward in the Yangtze basin to the borders of the mountainous country of eastern Szechwan, as at Ichang in Hupeh, and at Wanhsien, Szechwan, where a considerable series was collected by Dr. Walter Granger in 1921–22. According to Milne-Edwards, the original specimen came from Muping in central Szechwan, but it may be doubted if it is found at such elevations, and I am inclined to think that the type specimen really came from somewhere along the way nearer the Yangtze valley, for other and more experienced collectors have not found it at the higher levels in this province. In the coastal provinces, Clifford H. Pope collected it at Futsing, Chunganhsien, and Yenping, Fukien, as well as on the island of Hainan, where he secured two at Namfong and a single one at Nodoa. These Hainan specimens seem to be quite the same as those from Wanhsien, eastern Szechwan, and others from southern China, although the collector's field measurements of the tail are shorter than the average of other Chinese specimens. As these measurements were probably made by native collectors, they may be in some cases subject to correction, depending on the method of taking them. Nor have I been able to differentiate satisfactorily

the Fukien individuals from the more western Szechwan series, although A. B. Howell (1926, p. 137) has distinguished specimens from near Yenping as *C. grisea*, later regarding this as a subspecies of *C. attenuata*. His main diagnostic characters are the small size ("smallest of the all-gray Chinese members of the genus") and the dorsal coloration ("pure slate gray faintly grizzled"); but the measurements given are practically the same as those of the typical race, namely: head and body, 70 mm.; tail, 56; hind foot, 12; ear, 9; and the dimensions of the skull are the same, except that the length of the maxillary tooth row (misprinted 6.5 mm. in the original account and corrected to 8 mm. in the 1929 paper) is 1 mm. too small for the usual *C. attenuata;* while the peculiar silvery gray of the upper parts is undoubtedly the characteristic color of the usual winter pelage which differs strikingly from the darker brown of summer. Since the type was collected on November 23, it must have been in the fresh winter coat, as are those in a late-November series from Chekiang in the Museum of Comparative Zoölogy. The brownness of the two Yochow specimens with which Howell compared the three Fukien examples was undoubtedly a seasonal character, for winter skins (January) from Yochow, Hunan, in the collection of the American Museum of Natural History are quite indistinguishable from winter specimens from the type locality of *C. grisea*. I have, therefore, regarded the latter as a synonym of *C. attenuata*. The most northwesterly point at which the species has been taken is in the Wenhsien country, near Taochow, southeastern Kansu (Thomas, 1911d, p. 168), where two specimens were secured by the collectors of the Duke of Bedford's zoölogical expedition in 1909. There appears to be no evidence of its occurrence in the extreme west of Szechwan and Yunnan until the low country is again reached in southwestern Yunnan, where on the Namting River at the Burma border, Dr. Andrews's expedition secured a specimen, preserved in alcohol, and a skin and skull which seem to be this form. The skull of the latter specimen is a very little shorter than those of the series from eastern Szechwan, but the specimen otherwise is not noticeably different. In southern Szechwan, Thomas (1912e, p. 134) has recorded it from Chinfu Shan, near Nanchwan, and from the mountains fifty miles northeast of Chungking; and Howell (1929, p. 9) from Suifu. Probably, then, the species ranges quite across southern China at the lower altitudes.

Little seems to be known of the habits of this shrew. Unlike species of *Sorex* and of *Blarina*, the young of which are almost never trapped, the crociduras seem to leave their nests and wander about at a tender age, so that small adolescent individuals are occasionally taken. Thus Pope, on July 16, 1925, caught an immature specimen having a body length of only 55 mm., at Chunganhsien, Fukien, and the American Museum's collection has another very young one caught as it ran across the trail in the mountains near Yenping,

2,500 feet, in the same province, on August 31, 1920. The specimen previously mentioned, from the Namting River, on the Burma border, contained a single embryo on February 26, 1917, indicating that in the warmer part of the range at any rate, the young may be born early in the year, and that there is perhaps more than a single litter a year.

Probably the shrew recorded by Mell (1922, p. 16) as *Crocidura microtis* from Kwangtung and by Shih (1930, p. 2) as *C. fumigata* from Kwangsi, South China, is this species. The former author found it in wooded mountains with underbrush and stones. He once found a nest with five young, their eyes still closed, in a hole among rocks in late July, and at another time a nest with four young. Captives, he adds, must be watched lest they devour each other.

Specimens examined:—In all, ninety-four, as follows:

Kiangsu: Chingking, 1.
Chekiang: Dahyang, 2; Ningpo, 1; Tunglu, 9 (M.C.Z.).
Hupeh: Ichang, 1 (M.C.Z.).
Szechwan: Wanhsien, 42.
Hunan: Yochow, 3.
Fukien: Chunganhsien, 12; Futsing, 1; Yenping, 1.
Hainan: Namfong, 2; Nodoa, 2.
Yunnan: Namting River, at Burma border, 2.
China: no definite locality, 15.

49. **Crocidura dracula dracula** Thomas

WHITE-TIPPED SHREW

Crocidura dracula Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 686, 1912.
Crocidura prædax Thomas, *ibid.*, ser. 9, vol. 11, p. 656, 1923. Likiang valley, Yunnan.

Type specimen:—An adult male, skin and skull, in the British Museum, original number 34, from (probably) near Mengtsz, Yunnan, China. Orii Collection.

Description:—In general similar to *C. attenuata* but larger. The general color above is gray with a decided brownish tinge over the back, the head and sides less brownish. On close inspection, there is a slightly grizzled appearance due to silvery reflections from the pale-gray tips or subterminal portions of the hairs. The feet are thinly covered with dull whitish hairs. The tail is dark brown above and slightly but indistinctly paler below, terminating in a very short pencil which is whitish and forms a rather characteristic mark. The lower surface of the head and body is clear gray with a faint buffy or drabby wash. This description is from topotypes taken in February and March, and so representing the winter pelage, but no summer specimens are at hand for comparison.

The skull is essentially similar to that of *C. attenuata* but considerably larger. The teeth are likewise the same except for their greater size, but the first lower unicuspid is proportionately lower, nearly twice as long as its vertical height.

FIG. 9. Distribution Map.

Crocidura

1. *C. dracula dracula* 2. *C. dracula grisescens*

Measurements:—Four specimens which are virtually topotypes, and formed part of the same collection with the type, show the following dimensions as recorded on the labels by the collector; others are from the type region of *C. prædax*, and elsewhere.

No.	Head and body	Tail	Hind foot	Ear	Locality
14202 MCZ	103	78	16.0	10.5	Yunnan
14203 MCZ	84	74	16.5	12.0	Yunnan
14204 MCZ	86	62	15.0	11.0	Yunnan
14205 MCZ	88	73	16.5	12.0	Yunnan
85010	85	70	16.0	9.0	Yunnan
85011	93	70	17.0	9.0	Yunnan
44421	90	66	16.0	——	Yunnan
44445	85	72	17.0	——	Yunnan
44475	88	70	15.5	——	Yunnan
44495	90	80	17.0	——	Yunnan
44496	95	80	18.0	——	Yunnan
44453	105	78	19.0	——	Yunnan

CRANIAL MEASUREMENTS OF *CROCIDURA DRACULA*

No.	Greatest length	Basal length	Palatal length	Width of brain case	Width across molars	Upper tooth row	Lower tooth row	Locality
				C. dracula dracula				
14202 MCZ	——	——	——	——	6.5	10.3	9.8	Yunnan
14203 MCZ	23.0	21.0	10.6	10.4	7.1	10.0	9.5	Yunnan
14204 MCZ	24.0	22.0	11.2	10.2	7.3	10.7	9.8	Yunnan
14205 MCZ	23.0	21.0	10.8	10.0	7.0	10.3	9.8	Yunnan
BM (type)	23.3	22.4	——	10.2	7.1	10.5	——	Yunnan
44421	22.6	20.5	10.3	10.0	7.0	10.0	9.7	Yunnan
44422	23.1	21.0	11.0	10.5	6.9	10.4	9.5	Yunnan
44445	——	——	11.0	10.5	7.1	10.7	10.0	Yunnan
44475	——	——	10.9	10.0	6.9	10.3	9.5	Yunnan
44495	24.0	21.7	11.1	10.5	6.9	10.4	9.5	Yunnan
44496	24.0	22.5	11.5	10.8	7.3	11.0	10.0	Yunnan
				C. dracula grisescens				
252187 USNM (type)	21.6	——	——	9.9	——	9.3	——	Fukien

Working with a very much larger and more representative series than Thomas had at his command when he described *Crocidura prædax* from the Likiang valley of central Yunnan, I am quite unable to find any characters that will distinguish the animal of the latter region from typical *C. dracula* of southern Yunnan. The only character claimed is the supposed slightly greater size, but a series of careful measurements of topotypes of both fails to reveal any tangible difference. The type of *C. prædax* is said to have a skull length of 24.1 mm., but this is practically equaled by a topotype of *C. dracula*, while the skulls of other topotypes of the former are very slightly smaller. A large series also shows a slight amount of variation in the brownish tint of the upper surface, some specimens being distinctly browner or grayer than the average. In some cases this apparent difference may be partly due to the greater stretching in making up the skin by some collectors, and is independent of season. I am, therefore, regarding *C. prædax*, the type of which I have compared with that of *dracula*, as a synonym of the present species.

Occurrence and Habits:—This shrew was first described from Mengtsz in southeastern Yunnan, from a specimen taken by a Japanese collector, part of whose specimens, it appears, were abstracted and sold to parties in America. Four skins and skulls from this source are in the Museum of Comparative Zoölogy, and have served as a basis for comparison with the extensive series of shrews of this species secured by Dr. R. C. Andrews and Edmund Heller in their journey across Yunnan. They trapped numbers at altitudes up to 9,000 feet in Likiang, and a few at Tali Lake and near Yunnanfu. Their most northern locality was on the Yangtze River at Shihku, near the base of the Likiang Range. Thence westward, they found it all the way to the Burma

border on the Namting River at an altitude of only 1,700 feet above sea level. Doubtless the species occurs quite across southern China at the lower elevations (below 9,000 feet), but no records are available between Yunnan and eastern China where it is represented in Fukien by the very similar but slightly smaller race, *grisescens*. No doubt, too, its range extends for some distance into Indo-China, as indicated in Thomas's report on mammals from Tongking, secured by Stevens, among which were three crociduras with a skull length of 24 mm. taken at Ngai Tio (see Proc. Zool. Soc. London, 1925, p. 498). This species is, therefore, one whose main area of distribution is southern, reaching the southern parts of China.

Among the series taken by Dr. Andrews, was one exceptionally large male with a skull length of 26 mm., and a head-and-body length of 105 mm., affording additional evidence that old males may attain a considerably larger size than the average.

On the Namting River at the Burma border, 1,700 feet elevation, the breeding season must be early in the year, for Heller notes on the labels of three females taken between February 22 and 26 that each contained two embryos.

One secured at Likiang, 8,200 feet, was in full moult on October 4.

Specimens examined:—In all, ninety-nine, from the following localities:

Yunnan: Chaunglung, Salween River, 2,000 feet, 2; Chungpa, Mekong River, 6,900 feet, 3; Homushu Pass, 8,000 feet, 2; Likiang, 8,200 feet, 31; Likiang, 9,000 feet, 11 (including type of *prædax* in B.M.); Lukuchai, 2 (M.C.Z.); Mengtsz, 2 (M.C.Z.), 1 (B.M., the type); Namting River, Burma border, 1,700 feet, 23; Shihku, Yangtze River, 6,000 feet, 6; Shungkwan, Tali Lake, 6,000-6,500 feet, 3; Tashuitang, Salween drainage, 6,000 feet, 1; Yangpi River, Tengyueh road, 5,000 feet, 4; Yangpifu, 5,200 feet, 2; Yungchangfu, 5,500 feet, 4; Yunnanfu, 2.

50. **Crocidura dracula grisescens** A. B. Howell

Crocidura grisescens A. B. Howell, Journ. Mammalogy, vol. 9, p. 60, 1928.
Crocidura dracula grisescens A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 10, 1929.

Type specimen:—An adult female, skin and skull, No. 252187, U. S. National Museum, from Kuatun, northwestern Fukien, China. Collected by F. T. Smith.

Description:—Similar to the typical form but slightly smaller. A comparison of topotypes of this race with topotypes of *dracula* indicates that in coloration they are precisely alike, except that in the buffy wash of the belly the northeastern subspecies may be a little paler. The minute whitish tip to the tail is characteristic of both forms as well.

Unfortunately, skulls are not available for comparison, but according to its describer, the present form is slightly smaller in its cranial dimensions, and if collectors' measurements are to be trusted, in the tail length as well.

Measurements:—The following dimensions are those given for the type by Howell and here converted into millimeters, as well as those of two collected by Clifford H. Pope in northwestern Fukien.

No.	Head and body	Tail	Hind foot	Ear	Locality
252187 USNM (type)	89	61	16.1	9.6	Fukien
84755	87	59	15.0	9.0	Fukien
84756	90	65	14.0	6.0	Fukien

For cranial measurements of the type, see table on page 127.

Occurrence and Habits:—The specimens from the Kuatun district of northwestern Fukien, on which Howell bases this form, doubtless represent approximately the northeastern limits of the range of this shrew. Two other skins, without skulls, collected by Pope in the same region at Chunganhsien, bear out the claim that it is a slightly smaller and shorter-tailed race. The color is exactly the same as in the typical form, even to the minute white tail tip, but the skull measurements of the type are small and the field measurements in the two lots indicate a slightly shorter tail and hind foot than in the Tongking series.

Specimens examined:—Two, from Chunganhsien, Fukien.

51. **Crocidura ilensis ilensis** Miller

Crocidura ilensis Miller, Proc. Biol. Soc. Washington, vol. 14, p. 158, 1901.

Type specimen:—In the British Museum, an adult female, skin and skull, from Kukturuk, Ili, extreme western Sinkiang, central Asia.

Description:—A small shrew, above pale drab, the hairs drab gray subterminally, and darker gray at the base; below, silvery whitish gray, distinctly but not sharply contrasted with the back. Tail indistinctly bicolor, whitish gray below, but drab above like the back. Feet whitish gray.

The skull is somewhat smaller than that of the European *C. russula*, with the upper unicuspids smaller and less terete.

Measurements:—In the description of the type, Miller gives the following dimensions: head and body, 55 mm.; tail, 30; hind foot, 13 (without claws, 12); ear, —.

Skull: greatest length, 16.6 mm.; width of brain case, 8.4; width across molars, 6.0; upper tooth row, 8.4; lower tooth row, 8.0.

Occurrence and Habits:—Although described from so far to the westward, this shrew as a species seems to have a wide distribution across north-central Asia. Miller has indicated the close relationship with his *C. shantungensis*, which, on further study, I have ventured to regard as merely subspecific. Perhaps both are forms of *C. suaveolens*. The typical *C. ilensis* is said to have been found in the open grass country of western Sinkiang, and doubtless

is a pallid semi-desert form. Its claim to a place in the Chinese fauna rests upon the record of a female taken by Douglas Carruthers on the steppe south of Tarbagatai Mountains, in extreme western Mongolia, on the borders of Dzungaria (Thomas, 1912a, p. 392).

Specimens examined:—None.

52. **Crocidura ilensis lar** G. M. Allen

Crocidura lar G. M. Allen, Amer. Mus. Novitates, no. 317, p. 1, May 19, 1928.

Type specimen:—A male, skin only, No. 59940, American Museum of Natural History, from Tsagan Nor, central Gobi, Mongolia. Collected August 3, 1922, by Dr. R. C. Andrews.

Description:—A small, short-tailed, pallid race of *C. ilensis*. Upper sur-

FIG. 10. Distribution Map.

Crocidura

1. *C. ilensis lar*
2. *C. ilensis shantungensis*
3. *C. ilensis phœopus*

face of body and tail very pale grayish brown, nearly "wood brown" (Ridgway, 1912), the hairs of the body slaty at their base, with a minute subterminal ring of gray, and pale-brown tip. On close inspection a finely grizzled effect is given by the gray rings which show through and heighten the pallid appearance of the upper side. Chin and backs of the hands and feet white to the roots of the hairs, the rest of the lower surface of the body dull white, the individual hairs gray at the base, tipped with white. Tail rather sharply bicolor, white below, grayish brown above, well clothed with short hairs which form a small pencil, and with numerous scattered bristle hairs conspicuously projecting throughout its length.

The skull of the only specimen is unfortunately lost, but it is likely to be similar to that of the typical subspecies, perhaps a trifle smaller.

Measurements:—The type measured in the flesh: head and body, 60 mm.; tail, 29; hind foot, 12; ear, 8. The short tail and small hind foot are less than the average of the other races and are perhaps distinctive, apart from the very pallid coloration.

Occurrence and Habits:—The single specimen on which this form is based I originally described as a distinct species, but I believe it is probably best considered a subspecies of the wide-ranging *C. ilensis*, of which it is apparently but a pale, desert-living representative. The type of *C. ilensis* itself was taken in grass land, and thus in a somewhat different sort of country fifteen hundred miles distant to the westward. Dr. R. C. Andrews writes: "It was a great surprise to find a shrew in this desert. I can think of no place in which I should less have expected to find one. It was caught in the taxidermist's tent as it was about to run through. Even in the long grass about the edge of the lake, which is only thirty or forty yards away, there is a terrain of sand and gravel, very hard, from which the long coarse grass grows." Possibly the individual was a wanderer from the grassy cover. In spite of trapping, no others were secured, so that it must be local and uncommon where it occurs. Not only is its presence quite unexpected in the middle of the Gobi, but the record itself constitutes apparently the most northern occurrence of the genus yet known in Asia.

Specimens examined:—One only, the type.

53. **Crocidura ilensis shantungensis** Miller

Crocidura shantungensis Miller, Proc. Biol. Soc. Washington, vol. 14, p. 158, 1901.
Crocidura coreæ Thomas, Proc. Zool. Soc. London, 1908, p. 639; *ibid.*, 1911, p. 688. A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 10, 1929 (in part).

Type specimen:—A skin and skull, No. 86151, U. S. National Museum, from Chimeh, Shantung, China. Collected June, 1898, by Paul D. Bergen.

Description:—A very small, distinctly brownish shrew with white feet. Upper surface of head, body and the ears very nearly "russet" of Ridgway; below, whitish gray, the hairs slaty at the base; backs of the hands and feet clear whitish; tail bicolor, like the back above, whitish below, with numerous scattered bristle hairs along its length. The hairs of the dorsal surface have minute reflections of light when seen at certain angles. The winter pelage is slightly paler and grayer; clearer white below.

The skull and teeth are of the usual type in this genus; the first large upper incisor has a strong posterior cusp, and is followed by a large unicuspid whose tip projects slightly beyond this cusp; the two unicuspids that follow are much smaller, about half the height of the first, and a third its bulk in side view. The second of these unicuspids is slightly narrower than the one in front of it, while the tips of both are on about the same level as that of the main cusp of the large premolar.

Measurements:—This is the common small shrew of China, with a total length of not quite 100 mm. usually, the tail slightly less than the length of head and body combined. The following measurements were made in the field from fresh specimens.

For cranial measurements see table below.

No.	Total length	Tail	Hind foot	Ear	Locality
24320 MCZ	96	32	10.5	7.5	Chekiang
24323 MCZ	96	36	12.5	7.5	Chekiang
24325 MCZ	97	39	11.5	8.0	Chekiang
24326 MCZ	97	38	12.0	6.0	Chekiang

CRANIAL MEASUREMENTS OF *CROCIDURA ILENSIS* RACES

No.	Greatest length	Basal length	Palatal length	Breadth of brain case	Breadth across molars	Upper tooth row	Lower tooth row	Locality
			C. ilensis ilensis					
BM (type)	16.6	——	—	8.4	6.0	8.4	8.0	Sinkiang
			C. ilensis phœopus					
56019	16.4	15.8	7.3	7.5	5.0	7.4	6.6	Szechwan
56031	17.0	15.6	7.6	7.4	5.0	7.3	6.8	Szechwan
56039	17.0	15.8	7.5	7.6	5.2	7.2	6.6	Szechwan
7230 MCZ	17.6	16.0	8.0	8.0	5.5	7.8	6.9	Hupeh
			C. ilensis shantungensis					
24320 MCZ	16.5	15.2	7.8	7.8	5.2	7.6	6.7	Chekiang
24323 MCZ	16.7	15.0	7.5	7.9	5.0	7.4	6.8	Chekiang
24324 MCZ	16.6	15.0	7.7	7.0	5.0	7.6	6.8	Chekiang
24325 MCZ	——	——	8.1	8.0	5.3	7.5	7.2	Chekiang
172541 USNM	16.6	15.0	7.6	7.5	5.0	7.5	6.6	Shansi
172540 USNM	17.0	15.0	7.7	7.7	4.9	7.6	6.8	Shansi
172539 USNM	——	——	7.7	——	5.0	7.8	7.0	Shansi
86151 USNM (type)	——	——	——	——	——	7.8	7.0	Shantung

Occurrence and Habits:—This is the eastern representative of the common small reddish-brown shrew found across east-central Asia. It occurs in eastern China from the Yangtze valley northward into northern China, doubtless intergrading here with the nearly identical *C. coreæ* of the Korean peninsula. Indeed, Thomas (1908f, p. 639) records a single specimen from the Eastern Tombs, sixty-five miles east of Peiping, Hopei, as "closely similar" to the latter, but on geographic grounds I have thought it best to regard this as a representative of *C. shantungensis* or possibly as an intergrade between the two. Presumably, too, the specimen from thirty miles south of Fengsiangfu, southern Shensi, recorded by Thomas (1911e, p. 688) as *Crocidura coreæ*, is the same, as are also, in my opinion, the three specimens recorded by Howell (1929, p. 10) from five miles south of Taiyuanfu, Shansi. These I have examined through the courtesy of the U. S. National Museum, and find that they can be closely matched by specimens in corresponding pelage from Chekiang. They were taken in late October, and their very short pelage is apparently the winter coat not yet fully developed, for one seems still to retain a trace of the slightly darker summer pelage across the rump. The small series from Tunglu, Chekiang, collected by J. T. Wright for the Museum of Comparative Zoölogy, perhaps represents approximately the southern part of the species' range in eastern China, for none of the many collections made farther south in Fukien and elsewhere, includes it.

Specimens examined:—In all, fourteen, as follows:

Chekiang: Tunglu, 5 (M.C.Z.).
"China," 1; 3 (Univ. Mich.).
Shansi: five miles south of Taiyuanfu, 3 (U.S.N.M.).
Shantung: Weihsien, 1.
Shensi: forty-five miles south of Fengsiangfu, 1.

54. **Crocidura ilensis phæopus** G. M. Allen

Crocidura ilensis phæopus G. M. Allen, Amer. Mus. Novitates, no. 100, p. 7, December 28, 1923.
Crocidura coreæ G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 242, 1912 (in part).

Type specimen:—Adult female, skin and skull, No. 56013, American Museum of Natural History, from Wanhsien, Szechwan, China. Collected November 2, 1921, by the Central Asiatic Expeditions, Dr. Walter Granger.

Description:—A dark-brown shrew, like *C. ilensis shantungensis*, but less grayish and with dark-brown instead of whitish feet.

The entire dorsal surface of the body, the backs of the fore and hind feet, and the upper surface of the tail dark brown, nearly "mummy brown" (Ridgway, 1912), browner and less grayish than *C. i. shantungensis*. At the sides, the chin, throat, forearms and belly become rather abruptly whitish, the hairs, except at the chin, white-tipped, with dark-gray bases. The base of the tail

is gray beneath, but terminally is much the same dark brown on both surfaces. The long bristle hairs are scattered evenly throughout its length.

The skull has about the same dimensions as that of its neighbors, *C. i. coreæ* and *C. i. shantungensis*. It is small and delicate, with the rostrum not especially elongate, and the teeth quite as in those races. The first upper unicuspid is about double the height of the rounded posterior cusp of the first incisor. The second and third unicuspids are practically equal in height and cross-section, and reach the level of the tip of the paracone of the carnassial. The lachrymal foramen is exactly over the point of contact of the first and second molars.

Measurements:—In general dimensions this race does not seem to differ appreciably from those of eastern China. The following measurements were taken in the field from fresh specimens by Dr. Walter Granger.

No.	Head and body	Tail	Hind foot	Ear	Locality
56013 (type)	62	37	12	9	Szechwan
56019	56	38	10	8	Szechwan
56031	65	45	12	7	Szechwan
56039	60	44	12	9	Szechwan
7230 MCZ	58	40	13	—	Hupeh

For cranial measurements see table, page 132.

Occurrence and Habits:—The distribution of this dark-footed form of the small eastern *Crocidura* is still to be worked out, but probably includes the forested part of eastern Szechwan and southern Shensi with their more abundant rainfall. At Wanhsien, the type locality, on the Yangtze in eastern Szechwan, Dr. Walter Granger secured a fine series of twenty-three in the autumn and winter of 1921-22, and I refer to it also two specimens from Taipai Shan, in the Tsingling Range, southern Shensi. These localities seem to mark in a general way the southwestern limits of its distribution in China, for the various collecting parties that have visited this area failed to find it in the higher country of western Szechwan or farther south in the Yangtze basin. A single specimen in the Museum of Comparative Zoölogy from Ichang agrees with the Wanhsien series in its redder, less grayish, color and dark feet in comparison with the subspecies *C. i. shantungensis* of the drier country to the northward, and is the same individual that I previously (1912, p. 242) identified as *C. coreæ*.

Specimens examined:—In all, twenty-six, as follows:

Hupeh: Ichang, 1 (M.C.Z.).
Shensi: Taipai Shan, Tsingling Mountains, 2.
Szechwan: Wanhsien, 23.

55. **Crocidura vorax** G. M. Allen

Crocidura vorax G. M. Allen, Amer. Mus. Novitates, no. 100, p. 8, December 28, 1923.

Type specimen:—Adult male, skin and skull, No. 44383, American Museum of Natural History, from timber line forest on Ssu Shan (Snow Mountain), Likiang, Yunnan, China, at 12,000 feet altitude. Collected October 15, 1916, by Dr. R. C. Andrews and Edmund Heller.

Description:—A medium-sized, grayish-brown species, apparently allied to *C. russula.*

Head and body above a very pale grayish brown, nearly "wood brown" (Ridgway, 1912), with a minutely pepper-and-salt appearance, due to the presence of a narrow gray band below the brownish tips of the hairs. The color gradually pales at the sides into the gray of the belly, with a faint wash of buffy on the chest. The bases of the hairs everywhere are slaty, becoming paler, almost "slate gray," below, where they show through slightly. Tail distinctly bicolor, darker than the back above (nearly "clove brown"); clear gray below. The hair of the tail is thick enough to conceal the scales, and the scattered bristle hairs are chiefly present on the basal half. Ears thin, small and less conspicuous than usual.

The skull is of about the same size as that of *C. russula* of Europe, with a low but well-defined sagittal ridge and more prominent lambdoid ridges. The first upper unicuspid is largest, exceeding the posterior cusp of the large anterior incisor. The second and third unicuspids are practically equal in both vertical extent and cross-section, their tips practically on the same horizontal line as the anterior cusp (paracone) of the large premolar, instead of slightly exceeding it as in *C. russula.* The relations of the paracone to the main cusp of the premolar are about as in the latter, but the tooth seems to be much longer than in that species, its posterior edge forming a wide backwardly directed crescent, with the summit of the main cusp about over the center of the base of the tooth.

Measurements:—The type, as measured by the collector, shows the following dimensions: head and body, 72 mm.; tail, 51; hind foot, 13. These may be maximum dimensions, for five other specimens from the type locality average: head and body, 64.2; tail, 40.6.

The skull is obviously larger in its dimensions than that of the *ilensis* group to which the animal bears considerable external resemblance. The following dimensions are from topotypes.

CRANIAL MEASUREMENTS OF *CROCIDURA VORAX*

No.	Greatest length	Basal length	Palatal length	Breadth of brain case	Breadth outside molars	Upper tooth row	Lower tooth row	Locality
44382	19.0	17.3	8.6	8.3	5.6	8.0	7.5	Yunnan
44383 (type)	19.8	17.4	7.6	9.0	5.7	8.3	7.6	Yunnan
44387	——	——	8.6	——	5.7	8.1	7.5	Yunnan

Occurrence and Habits:—In its rather long fur, brownish coloration, and thin small ears, this shrew has at first sight much the appearance of a *Sorex* as the skins are made up. Although in general resembling also *Crocidura ilensis phœopus*, it is a much paler brownish gray, and of distinctly larger dimensions, as is obvious on comparison of the skulls. The length of the hind foot is only slightly greater, but the fore feet, when skins of the two are laid side by side, are obviously larger. It is apparently not distantly related to *C. russula* of Europe, of which perhaps it should be regarded as a subspecies, but until a general review of the relationships of the Asiatic species of the genus can be made, I have hesitated to make a more definite assignment.

This shrew has been taken at high altitudes on the Likiang Range, between 9,000 and 12,000 feet (timber-line), and I have referred to it also a few individuals from lower levels, including one from Taku Ferry, 6,000 feet, and one from Chitien, 6,400 feet, both in the Yangtze valley near the eastern base of the range, as well as one from Minkai, Tali Lake, 7,500 feet, a short distance to the south. No doubt it is this shrew of which Thomas (1922b, p. 394; 1923, p. 657) records specimens from 9,000-13,000 feet on the Likiang Range, as a "small species of the *russula* group."

The collector's note on the type specimen states that when taken it was in the act of devouring a mouse (*Apodemus*) caught in a trap.

Specimens examined:—In all, nine, as follows:

Yunnan: Ssu Shan, Likiang Range, 5; Peishui, Likiang Range, 1; Taku Ferry, Yangtze, 1; Chitien, Yangtze, 1; Minkai, Tali Lake, 1.

56. **Crocidura rapax** G. M. Allen

Crocidura rapax G. M. Allen, Amer. Mus. Novitates, no. 100, p. 9, December 28, 1923.

Type specimen:—Adult male, skin and skull, No. 44321, American Museum of Natural History, from Yinpankai, Mekong River, southern Yunnan, at 9,000 feet altitude. Collected December 25, 1916, by Dr. R. C. Andrews and Edmund Heller.

Description:—A small shrew of the *C. russula* group, resembling *C. vorax* in size and proportions, but the entire dorsal surface a much richer brown, nearly "bister" (Ridgway), slightly peppered with gray on the head and shoulders. Below, a light "mouse gray." Feet thinly covered with minute gray hairs. Tail bicolor like the body, the bristle hairs rather few and scattered.

The skull is like that of *C. vorax*, but slightly more delicate.

Measurements:—The collector's measurements of the type are: head and body, 64 mm.; tail, 42; hind foot, 12.5. The skull measures: greatest length, 18; basal length, 16.3; palatal length, 8.0; width of brain case, 8.2; width outside molars, 5.3; upper tooth row, 8.0; lower tooth row, 7.4.

Occurrence and Habits:—Although treated as a distinct species, this shrew is probably only a richer-colored, lowland form of the preceding, and may even prove to be not very different when a larger series is available. In fact, to judge from descriptions alone, both may be closely related to *C. indochinensis*, or possibly inseparable from it. For the present, therefore, I have retained *C. rapax* as originally published. In addition to the type, the collection of the American Museum of Natural History contains a skin from Homushu Pass, which though grayer, may nevertheless be the same, and A. B. Howell has recorded five specimens in the U. S. National Museum from Yochow, Hunan, as "perfectly typical."

Specimens examined:—Three, including the type from Yinpankai, Mekong River, Yunnan, and a skin and an alcoholic from Homushu Pass, Yunnan.

Genus **Anourosorex** Milne-Edwards

Anourosorex Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 70, p. 341, February, 1870; Ann. des Sci. Nat., Zool., ser. 5, vol. 13, art. 10, 1 p., March, 1870; Ann. Mag. Nat. Hist., ser. 4, vol. 5, p. 306, April, 1870; Recherches pour servir à l'Hist. Nat. des Mammifères, p. 254, pl. 38, fig. 1; pl. 38A, figs. 1-1j, 1868-74.
Pygmura Anderson, Proc. Zool. Soc. London, 1875, p. 229, footnote.
Anurosorex Anderson, Ann. Mag. Nat. Hist., ser. 4, vol. 16, p. 282, 1875; Anat. and Zool. Researches Western Yunnan, p. 150, pl. 5, 1879.

This genus represents a fossorial modification of the white-toothed shrews, that stands in somewhat the same relation to *Crocidura* as *Blarinella* does to *Sorex*. In external appearance it is at once distinguished by the minute and practically naked, scale-covered tail which is slightly shorter than the hind foot, by the scaly feet, well-developed fore and hind claws and somewhat shortened bluntly pointed snout. The eyes are greatly reduced and are not evident in skins, while the external ear is a bare rim, not visible above the fur of the head. The skull, in accordance with the burrowing habits of the animal, is more solid than in *Crocidura*, with a low but strong sagittal ridge and low occipital ridges that project slightly behind, flange-like, forming a continuous crescent as viewed from behind, instead of two straight crests meeting at an angle. The parietal surface of the brain case is faintly rugose for muscle attachment, and its outline is laterally produced to form a strong angle at the point of greatest breadth. A small oval foramen is present medially between the first upper unicuspids.

The teeth are stout and have prominent cusps and angles. The dentition shows additional modification beyond that of *Crocidura* in the reduction still further of the unicuspids so that there are only two between the first large incisor and the large carnassial of the upper jaw, while at the posterior end of the molar series, both upper and lower last molars are much reduced in size, so that the upper is merely a low transverse ridge in which the identity of the inner cusp or protocone is hardly obvious. The large upper premolar is de-

cidedly molariform, with its outer portion consisting of the usual small anterior paracone, then a wide blade-like compressed main cone which is broadly extended behind, while the inner portion has a small low but evident pair of cones one behind the other, closely simulating the protocone and hypocone of the first molar. The latter is the largest of the molars, and is remarkable in having the antero-external parastyle large and rounded as well as the postero-external metastyle, while the mesostyle is greatly reduced, and represented only by a thin ridge connecting the paracone and metacone, so as to produce a long cutting edge. The second upper molar has only about half the crown area of the first, on account of the great reduction of the posterior half of the tooth, in which the metacone and hypocone are very small and the mesostyle and metastyle much reduced. The third upper molar has a crown area barely equal to that of the metacone of the second, and lies transversely to the tooth row, inside the outer corner of the second. In the lower jaw, the long blade-like incisor has its cutting edge straight, while the molars like those of the upper jaw are graduated in size, the first largest and long in profile view, the two others successively smaller, the third very small but with three obvious cusps representing the paraconid, protoconid and hypoconid. The tooth formula is probably to be interpreted as follows: $i.\frac{2}{1}$ $c.\frac{1}{1}$ $pm.\frac{4}{4}$ $m.\frac{3}{3} = 26$.

This interesting genus, which at first sight so much recalls the American *Blarina*, but really is a parallelism from another division of the Soricidæ, is confined to the highlands of western China and the adjacent parts of eastern India and Indo-China. It was one of the many remarkable discoveries of that indefatigable traveler and collector, Père Armand David, who was the first European naturalist to secure small mammals from Szechwan. Milne-Edwards, in a brief preliminary paper on his collections, named and tersely characterized the new genus, without even giving a specific name, reserving this for his later account in the "Recherches." Meanwhile, before this work had reached India, Dr. John Anderson had obtained the genus from Assam, and given a preliminary diagnosis of it under the name *Pygmura*.

57. **Anourosorex squamipes** Milne-Edwards

Anourosorex squamipes Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 264, pl. 38, fig. 1; pl. 38A, figs. 1-1j, 1868-74.
Anourosorex squamipes capnias G. M. Allen, Amer. Mus. Novitates, no. 100, p. 10, 1923.
Anourosorex assamensis capito G. M. Allen, *ibid.*, p. 11.

Type specimen:—No type specimen is mentioned in the original account of this species, nor any definite locality, beyond the statement that it occurs "dans les montagnes du Sé-tchouan et du Tibet." It is assumed, however, that Père David's specimens came from the principality of Muping in central Szechwan, and that they are still preserved in the Muséum d'Histoire Naturelle at Paris.

Description:—Fur fairly long, about 9 mm. on the center of the back, becoming slightly longer on the rump, about 11 mm. General color above a dark mouse gray to fuscous, with the faintest suggestion of brown; a small spot of ochraceous tawny is usually present on each cheek; below, paler gray with a slight wash of buffy over the tips of the hairs. Backs of the hands and feet dusky, the fingers and claws white. The feet, like the tail, are practically naked, but the latter has a few minute terminal hairs, although otherwise its scaly covering is dark brownish.

FIG. 11. Distribution Map.

Anourosorex

A. squamipes

The cranial characters have been briefly described in the account of the generic distinctions. In this species the skull is slightly shorter proportionally than in *A. assamensis*, forming about 25 per cent. of the total length. It is characteristically heavy in build, with stout, broad teeth. The upper incisors are broadened out by the formation of distinct internal ledges, while the outer corners of the large upper premolar and the first molar are produced laterally to form distinct angles. In one of a series of twelve skulls, the third upper molar is missing on both sides, with no trace even of an alveolus.

Measurements:—The collector's measurements of a series from Wa Shan, in central Szechwan, are as follows:

No.	Total length	Tail	Hind foot	Locality
7535 MCZ	102	13	15.0	Szechwan
7536 MCZ	104	9	16.0	Szechwan
7537 MCZ	101	13	16.0	Szechwan
7538 MCZ	99	15	15.5	Szechwan
7539 MCZ	100	13	16.0	Szechwan
7543 MCZ	100	14	15.0	Szechwan
7545 MCZ	92	12	15.0	Szechwan
7547 MCZ	98	13	15.0	Szechwan
7546 MCZ	96	13	15.0	Szechwan
7550 MCZ	96	10	14.0	Szechwan

CRANIAL MEASUREMENTS OF *ANOUROSOREX SQUAMIPES*

No.	Greatest length	Basal length	Palatal length	Breadth of brain case	Breadth across molars	Upper tooth row	Lower tooth row	Locality
7532 MCZ	24.7	22.0	12.0	13.2	7.6	11.3	10.4	Szechwan
7533 MCZ	24.5	21.8	12.0	12.9	7.5	11.5	10.4	Szechwan
7534 MCZ	24.8	22.0	12.0	13.4	7.5	11.6	10.5	Szechwan
7535 MCZ	25.5	22.5	11.2	13.2	7.5	11.5	10.6	Szechwan
7536 MCZ	25.0	22.1	12.0	12.6	7.3	11.1	10.3	Szechwan
7539 MCZ	26.0	23.0	12.0	14.0	8.0	11.8	10.7	Szechwan
7543 MCZ	24.4	22.5	12.0	13.7	7.8	11.9	10.7	Szechwan
7545 MCZ	23.3	21.1	11.2	12.0	7.1	11.0	10.0	Szechwan
7546 MCZ	24.4	22.0	12.0	12.2	7.1	11.2	10.0	Szechwan
7548 MCZ	25.0	22.5	12.0	13.5	7.6	11.5	10.5	Szechwan
44502	21.5	19.5	10.4	11.4	7.0	10.0	9.0	Yunnan
44506	23.0	20.8	11.5	11.6	—	11.0	10.0	Yunnan
44516	23.5	21.3	11.8	13.0	7.6	11.3	10.2	Yunnan

Occurrence and Habits:—The range of this stump-tailed shrew seems to coincide more or less with the forested highlands of western China, from the Tsingling Range on the southern border of Shensi, westward to extreme southern Kansu, and thence south across Szechwan and probably northern Yunnan, passing into southern Yunnan. It was one of the many remarkable discoveries of Père Armand David, who first met with it in central Szechwan,

probably in the principality of Muping, where so large a number of his finds were made. The only note on its habits is the remark of Milne-Edwards that it usually keeps in its underground tunnels, and is common in the plains and mountains of eastern Tibet and Szechwan, the latter province being at that time considered a part of Tibet. Later, David (1873) found the species again, not far from Sianfu in southeastern Shensi, where he lived for three and a half months. Dr. Andrews also procured it in Shensi, a little farther west, at Taipai Shan, in the Tsingling Range, at 10,000 feet altitude. Still farther west, it has been recorded by Buechner (1892, p. 151, 105 of separate) from near Ssigu, Kansu, where the Russian explorer, Berezovski, found a dead one, and brought it back to Leningrad. It is common in Szechwan, where its easternmost record seems to be at Wanhsien, on the Yangtze River, whence Dr. Granger secured a specimen for the American Museum, and A. B. Howell records (1929, p. 11) two others in the U. S. National Museum, as well as seven from Suifu on the same river in the southern part of the province. It seems to be most frequently found in central Szechwan, for the late Walter R. Zappey secured at Wa Shan (or Yashan) a fine series of seventeen for the Museum of Comparative Zoölogy in 1907, and the Stötzner Expedition seven at the same place (Jacobi, 1922, p. 2), while Thomas (1911d, p. 168; 1912e, p. 134) records it from several stations just south or west of the type locality, as at forty-five miles west and southwest of Yachow, and at Omei Shan, as well as from Chinfu Shan (near Nanchwan); fifty miles north of Chungking; near Yuenchinghsien in western Szechwan; and twenty-one miles northeast of Chaotungfu, Yunnan, 5,800 feet. There appears to be but one record of its presence in Hupeh, at the same time the most easterly known record for the animal, namely, two taken in 1907 by W. R. Zappey, at Changyanghsien and one at Hsienshanhsien, both localities not far from Ichang, where the forested highlands really begin (G. M. Allen, 1912).

To the southward, it was found at various localities in southwestern Yunnan by Dr. R. C. Andrews, up to altitudes of 10,000 feet, as in the Chungtien district and on the Yangtze River above Taku Ferry, while on the Mekong River specimens were taken at various places up to 8,000 feet. It seems odd that no evidence of its presence has been found on the Likiang Range.

Osgood (1932) is doubtless correct in placing the two races I described as *A. s. capnias* and *A. s. capito* in the synonymy of this species, for the differences observed, though at first puzzling, appear with study of further series to be largely individual or seasonal.

Specimens examined:—In all, forty-nine, as follows:

Hupeh: Changyanghsien, 2 (M.C.Z.); Hsienshanhsien, 1 (M.C.Z.).
Shensi: Taipai Shan, 10,000 feet, 2.
Szechwan: Wanhsien, 1; Wa Shan, 19 (M.C.Z.); Suifu, 4 (U.S.N.M.).

Yunnan: Chungtien district, Tomulang, 10,000 feet, 1; and Peitai Mountain, 10,000 feet, thirty miles south of Chungtien, 2; twenty miles north of Taku Ferry, Yangtze River, 10,000 feet, 2; Mekong River, Hsiaokela, 8,000 feet, 5; Mekong River, Yinpankai, 9,000 feet, 1; Mekong River, Lachumi, 9,000 feet, 1; Mekong River, Chiangwei, 8,000 feet, 1; Mucheng, Salween drainage, 7.

Genus **Chimarrogale** Anderson

Chimarrogale Anderson, Journ. Asiatic Soc. Bengal, vol. 46, pt. 2, p. 262, 1877.
Crossopus Gray, Ann. Mag. Nat. Hist., ser. 1, vol. 10, p. 261, 1842 (part, for *Crossopus himalayicus*).
Crocidura Anderson, Proc. Zool. Soc. London, 1873, p. 231 (part).

Just as the Old World genus *Neomys* is an aquatic modification of a soricine type, so this genus is an aquatic form of the crocidurine or white-toothed shrews. Its external modifications for aquatic life lie principally in the well-developed feet with a fringe of flattened stiff hairs on both lateral edges of each toe in place of a web for swimming; in the somewhat waterproof nature of the pelage through the glossy, burnished tips of the guard hairs, and especially of the elongated hairs of the rump, tending to keep out water, and again in the reduced ears with a valvular antitragus for closing the openings when under water. The tail is relatively long, about equaling the body length. The skull is peculiarly shaped, with a broad flattened brain case which in profile makes a nearly flat angle with the dorsal outline of the rostrum. The latter has its upper outline nearly parallel with the alveolar margin. The bony structure of the skull is markedly thin and light, with the sagittal and lambdoid crests very low. There is a pair of minute foramina in the palate between the two first unicuspids. The teeth are white throughout and relatively light. The anterior upper incisors have their main shaft nearly vertical, slender, and sharp-pointed, with a low posterior cusp. Then follow three unicuspids of practically the same height and cross-section, about as high as the anterior cusp of the large premolar following. This premolar has its main cusp low, about one and a half times as high as its anterior cusp, while its postero-external commissure as well as that of the first molar are produced backward, forming a blade-like cutting edge. The second molar lacks this extension, and has the paracone and metacone of practically equal size, while the hypocone of both the large premolar and the two anterior molars is low but evident, and succeeded by a still smaller but distinct cingulum cusp. The third upper molar is much reduced in size, but shows a fairly distinct protocone and paracone, with a posterior transverse ridge or commissure. In the lower jaw, the large blade-like incisor has its cutting edge straight; the second of the two smaller teeth following is slightly notched at its upper posterior edge, while the three molars show a decrease in size from front to back, but the third lower molar, even though small, shows all the cusps still present. The tooth formula may be interpreted as follows: $i.\frac{3}{1}$ $c.\frac{1}{1}$ $pm.\frac{1}{1}$ $m.\frac{3}{3} = 28$.

This genus of water shrews occurs in the hill country from Darjeeling and Sikkim, India, eastward across southern China to the mouth of the Yangtze, and southward into Indo-China, and is found also in Japan. Two species have been described from China; one of these is represented by two subspecies, both of which are closely similar to the Indian *C. himalayica*. For an excellent anatomical account of the latter, see Anderson, 1879, p. 139. The species and races may be distinguished by the following key.

KEY TO CHINESE SPECIES AND SUBSPECIES OF *Chimarrogale*

A. Belly white, with a sharp line of demarcation from the slaty color of the back ..... *C. styani*

B. Belly grayish washed with brown, grading by imperceptible degrees into the color of the back ..... *C. himalayica*

a. Slightly larger, hind foot, without claws, 23 mm. or more ... *C. himalayica himalayica*

b. Slightly smaller, hind foot, without claws, 22 mm. or less ... *C. himalayica leander*

58. **Chimarrogale himalayica himalayica** (Gray)

Crossopus himalayicus Gray, Ann. Mag. Nat. Hist., ser. 1, vol. 10, p. 261, 1842.
Chimarrogale himalaica Anderson, Anat. and Zool. Researches Western Yunnan, p. 139, pl. 5, figs. 17-30, 1879.
Chimarrogale himalayica A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 11, 1929.

Type specimen:—The type is a skin, formerly mounted, No. 42.2.18.1 in the British Museum, and from which the anterior teeth have been extracted. The locality is not mentioned by Gray, and on the label is merely "Himalaya," C. Drummond, collector.

Description:—Apparently the color is identical with that of the eastern subspecies, a uniform blue-gray above, slightly darker in the middle of the back, and minutely peppered with pale whitish subterminal bands on most of the hairs. Longer white-tipped hairs are evenly sprinkled throughout the coat, and are especially numerous and long on the rump. The color of the back grades by imperceptible degrees into the paler mid-ventral region which is distinctly washed with brownish. Backs of the feet light brown. Tail a uniform dark brown above and all around at the terminal third or more, the basal third below white.

The skull of the type is not preserved, except for the anterior teeth. Its chief characters have already been mentioned.

Measurements:—No fresh measurements of Chinese specimens are available, but the size does not greatly differ from that of the race *C. h. leander*. In the type as mounted, the tail measures about 80 mm., the hind foot with claw 23.3 mm. In a specimen from Tongking in the British Museum, the hind foot without claw is 23 mm.

CRANIAL MEASUREMENTS OF *CHIMARROGALE HIMALAYICA*

No.	Greatest length	Basal length	Palatal length	Breadth of brain case	Breadth across molars	Upper tooth row	Lower tooth row	Locality
			C. himalayica himalayica					
27451 MCZ	26.9	——	12.8	14.2	8.5	12.5	10.5	Yunnan
240167 USNM	26.0	23.0	12.0	13.5	8.0	11.4	10.1	Yunnan
8.7.6.17 BM	27.8	24.5	13.3	13.8	8.4	12.4	11.1	Kashmir
			C. himalayica leander					
2.6.10.3 BM (type)	25.5	22.3	12.0	——	7.1	11.0	10.3	Fukien
84793	25.6	23.2	12.8	12.5	8.0	11.8	10.6	Fukien
84794	25.0	22.8	12.2	13.6	8.5	11.5	10.5	Fukien
84795	26.0	23.6	13.0	13.8	8.4	11.5	10.6	Fukien

Occurrence and Habits:—Little is known of this species, but it is apparently present in small numbers along the mountain streams of Yunnan, westward into the Himalayan region. After examining the type and other specimens in the British Museum, I cannot see that the Yunnan examples are different, and A. B. Howell reached the same conclusion. Anderson (1879, p. 139) gives a minute account of a specimen which he caught in a mountian stream "behind our camp at Ponsee, in the Kakhyen hills, at an elevation of 3,500 feet," on the border of western Yunnan. He "observed it running about over the stones in the bed of the stream and plunging freely into the water. It was evidently engaged in feeding, and in addition to insects and aquatic larvæ, it is probable that . . . it may kill young fish."

Specimens examined:—In addition to the type and specimens from Sikkim, Kashmir, and Tongking in the British Museum, I have examined the following from China:

Yunnan: Likiang, 2 (1 each in M.C.Z. and U.S.N.M.).

59. **Chimarrogale himalayica leander** Thomas

Chimarrogale leander Thomas, Ann. Mag. Nat. Hist., ser. 7, vol. 10, p. 165, 1902.
Chimarrogale himalayica Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 2, 1930; *ibid.*, no. 8, p. 1, 1930.

Type specimen:—A skin and skull, No. 2.6.10.3, British Museum, from Kuatun, northwestern Fukien, China, 1,200 meters altitude. Winter. Collected by F. W. Styan.

Description:—Similar to the typical form but slightly smaller, the color somewhat paler, the white of the tail not extending to the tip on the under side.

Color above blackish slate, minutely grizzled with paler, due to the presence of many all-light-gray hairs mixed with others having a gray base, then a dark brown subterminal ring and a minute pale tip. Sprinkled among the other hairs are many longer ones with pale shining tips that project and serve to waterproof the fur; these increase in length and conspicuousness posteriorly,

and produce a distinctly hoary appearance over the hind quarters. Lower surface covered with shorter, smooth fur of a dark gray washed with brown. Feet pale brownish, with a darker brown line extending to the outer side; the fringing hairs of the toes white. Tail covered with short hairs that barely conceal the scales; color brown above, paler and somewhat silvery below, nearly clear whitish on the basal half. Vibrissæ short, extending back to the ear, white.

The skull does not apparently differ from that of *C. himalayica* except in the slightly smaller size and smaller teeth. The great reduction of the posterior cusp of the first upper incisor and the specialization of the tooth through its sharply pointed main cusp are generic characters.

Measurements:—Since no flesh measurements were available of the type specimen, the following are of value from a series of topotypes collected by Mr. Clifford H. Pope.

No.	Head and body	Tail	Hind foot	Ear	Locality
84793	106.0	84.0	22.0	5	Fukien
84794	80.0	90.0	21.0	7	Fukien
84795	108.0	91.0	23.0	10	Fukien
24307 MCZ	95.5	80.5	20.5	—	Chekiang

For cranial measurements, see table under *C. h. himalayica.*

Occurrence and Habits:—This race of the Himalayan Water Shrew is apparently fairly common in suitable localities, such as along upland streams in eastern China. In addition to the original specimen from Kuatun in northwestern Fukien, three others were taken at Chunganhsien, close to the same place by Mr. Clifford H. Pope in May, June, and early July, 1926. He notes that the native name is "shui lao shu" or water rat, and though seldom taken, it is said to be fairly common in the Kuatun streams. His hunter was certain he had seen the same animal in the Futsing Mountains in the same province at hardly 300 feet altitude, but all efforts to procure it there failed. In life the tail is four-sided. The most northerly point of its known range is furnished by a single skin without skull collected by J. T. Wright at Tunglu, northern Chekiang, and now in the Museum of Comparative Zoölogy. To the southwest it extends its range probably across most of the mountainous area of southern China, but the actual records are at present few. These are of several from the Yao Shan district of Kwangsi (Shih, 1930, p. 2) and ten others from the Yao Shan region, North River, in Kwangtung (Shih, 1930a, p. 1; 1931, p. 2). In the mountainous regions of the latter province, Mell (1922, p. 16) also secured it, and records two apparently newly born young found on May 12, in Mahutze Shan, 750 meters altitude. Two adult males and a female were taken at "Drachenkopf," Kwangtung, in a deep valley along a rocky brook, and another under a large stone by a brook at Mahutze Shan. It is evidently

confined to the vicinity of small streams and is supposed by Anderson to live upon insects and small fishes. As a subspecies this is barely distinguishable on the ground of its slightly smaller size, and doubtless intergrades with the typical race in western China.

Specimens examined:—In all, five, namely:
Chekiang: Tunglu, 1 (skin only, M.C.Z.).
Fukien: Chunganhsien, 3; Kuatun, 1 (B.M., type).

60. **Chimarrogale styani** De Winton and Styan

Chimarrogale styani De Winton and Styan, Proc. Zool. Soc. London, 1899, p. 574.

Type specimen:—A female, skin and skull, No. 99.3.1.8, British Museum, from Yangliupa, northwestern Szechwan. Collected June 16, 1897, by F. W. Styan.

Description:—Above, uniform dark slaty black from the shoulders backward, interspersed with shining white hairs increasing in length and in numbers on the rump; below, including the lips and side of the face to the level of the eye, white washed with yellow, a sharp line dividing the dark and light surfaces. Feet white except a narrow area on the dorsal surface, running toward the fifth digit. Tail, short-haired, tapering and colored above like the back, below whitish to the tip.

No comparative account of the skull characters is given by the author, but from an examination of the type it appears that the skull is slightly smaller than that of *C. himalayica*.

Measurements:—The only available measurements are those of the type, taken from the dried skin, and a second specimen in the British Museum, which I have had the privilege of examining.

No.	Head and body	Tail	Hind foot	Ear	Locality
99.3.1.8 BM	(108)	(61)	20.0	—	Szechwan
15.2.1.2 BM	100	85	17.5 (s.u.)	6	Burma

CRANIAL MEASUREMENTS OF *CHIMARROGALE STYANI*

No.	Greatest length	Basal length	Palatal length	Breadth of brain case	Breadth across molars	Upper tooth row	Lower tooth row	Locality
99.3.1.8 BM (type)	——	——	11.3	——	7.1	10.5	9.6	Szechwan
15.2.1.2 BM	23.9	21.7	11.0	11.8	7.0	9.9	9.3	Burma

Occurrence and Habits:—This rare aquatic shrew is known from but two specimens, the type in the British Museum, and a second specimen secured by F. Kingdon Ward in the mountains of Upper Burma, at an altitude of 11,000 feet (Thomas, 1915d, p. 335). He writes (F. K. Ward, 1921) that he captured it by hand as it swam in a small brook on Imaw Bum in the daytime. Evidently it resembles in its habits the other species of the genus, frequenting

alpine streams. It is, however, very different in appearance, for the sharply delimited white ventral surface is, as Thomas says, very similar to the color pattern of a *Neomys*, or even of the American water shrews (*Neosorex*). In this respect, too, it is similar to the Japanese species, *C. platycephala*, with which it is perhaps more closely related than with *C. himalayica*. Except for the smaller size of *C. styani*, it is otherwise rather similar to the last, and it is, therefore, interesting to find the two living in much the same region. Possibly, however, the present species is somewhat more northern in distribution, and will yet be found in Kansu and the Tsingling region.

Specimens examined:—I have examined both the above-mentioned specimens:

"Northwestern Szechwan": 1 (B.M., the type).
Upper Burma: Naung Chaung valley, Wulaw Pass, 1 (B.M.).

Genus **Nectogale** Milne-Edwards

Nectogale Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 70, p. 341, 1870; Ann. des Sci. Nat., Zool., ser. 5, vol. 13, 1 p., 1870; Ann. Mag. Nat. Hist., ser. 4, vol. 5, p. 306, 1870; Recherches pour servir à l'Hist. Nat. des Mammifères, p. 266, 1868-74.

Although Milne-Edwards regarded the water shrews of the Old and New Worlds (*Crossopus*[=*Neomys*], *Neosorex*, and *Nectogale*) as forming a special subfamily, Crossopinæ, annectant between the more typical shrews and the desmans, it seems now obvious that the first two are specializations of the Soricinæ, while the last is a crocidurine, representing a still further adaptation of the water-living type already foreshadowed by *Chimarrogale*. In its habits it is doubtless more aquatic, and the teeth are specialized, probably for fish-eating, through the more narrowed and prehensile nature of the crowns of the anterior part of the jaws. This genus of water shrews is externally characterized by the long snout, reduced valvular ears, the tail modified for swimming by the development of median and lateral keels of stiff short hairs, by the webbed feet, and by the abundance of long, white-tipped over-hairs that serve to shed water. These and the characters of the skull are excellently shown in Milne-Edwards's plates (1868-74, pls. 39, 39A). He describes the tail as quadrangular at the base, triangular in section in the middle third, and laterally compressed in its terminal portion. Basally a line of short stiff bristles marks the lower angle on each side, beyond which the two lines run together, forming a ventral fringe along the median line quite to the tip of the tail, corresponding to a dorsal fringe along the terminal three-quarters of the upper side. Similar but shorter lateral fringes are present along the middle third of the tail. The fore and hind feet are webbed to the base of the terminal phalanges, and their edges are provided with a fringe of short, stiff, flattened hairs like those in *Chimarrogale*, to enhance the swimming power of the feet. The feet are covered dorsally by small scales, which on the toes become trans-

verse scutes. Most remarkable are the disk-like pads of both fore and hind feet. These, as shown in Milne-Edwards's excellent figures, consist chiefly of a wide transverse pad across the bases of digits 2 to 5 of the fore foot and of 3 and 4 of the hind, that of the fore foot nearly a third larger than that of the hind; back of this on each foot is a pair of narrower transverse pads, one from the base of the first digit and one from the opposite side of the foot, both of which nearly touch in the center of the palm. Two others, forming a similar transverse row, are shown at the base of the fore foot, but in the hind foot there is only one transverse pad on the inner side parallel to that at the base of the first toe, while the metatarsal tubercle is very small and oval with its axis longitudinal. These extraordinary pads must be useful as adhesive disks in climbing out on wet stones in the streams where the animal lives, as Milne-Edwards suggests.

The skull is extraordinarily flattened, with a very broad brain case, the dorsal profile of which forms nearly a continuation of the same straight line as that of the rostrum. Milne-Edwards's figures show a pair of small incisive foramina between the first pair of upper unicuspids, and two linear palatal openings about opposite the large premolar. The teeth are mainly notable for the slender and somewhat unusually elongate first incisors, both upper and lower, while the basal cusp of the upper is much reduced. The three upper unicuspids are low and rather more elongate in the axis of the tooth row than in other shrews, the two first nearly of equal height and cross-section, the third (the canine) smaller. In the lower jaw the small canine and premolar have each a central cusp with two smaller cusps, one in front, the other behind the central one. The cusps of the molar teeth are shorter, but the third molar is not more reduced than in *Crocidura*. The tooth formula is the same, namely: $i.\frac{3}{1}$ $c.\frac{1}{1}$ $pm.\frac{1}{1}$ $m.\frac{3}{3} = 28$.

Only a single species is known, which is confined to mountain streams of the Chinese highlands westward into Sikkim, where it is represented by a slightly browner subspecies.

61. **Nectogale elegans** Milne-Edwards

WEB-FOOTED WATER SHREW

Nectogale elegans Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 70, p. 341, February, 1870; Ann. des Sci. Nat., Zool., ser. 5, vol. 13, art. 10, 1 p., March, 1870; Ann. Mag. Nat. Hist., ser. 4, vol. 5, p. 306, April, 1870; Recherches pour servir à l'Hist. Nat. des Mammifères, p. 266, pls. 39, 39A, figs. 1-1l, 1868-74.
Nyctogale elegans David, Proc. Zool. Soc. London, 1873, p. 555 (*errorim*).

Type specimen:—No type is mentioned in the descriptions, but the original specimen from Muping, Szechwan, is presumably still in the Muséum d'Histoire Naturelle at Paris.

Description:—General color above slaty gray, overlain, except on the head,

with longer hairs having gray bases and prominent white tips, which become more abundant posteriorly. Lower surface of the body from the upper lips and chin to the tail, white, rather sharply marked off from the color of the upper side, the hairs everywhere gray at the base. The feet are brown, their fringes of short hairs white; and the tail is like the back, with its fringes white. The prominent vibrissæ are white. Milne-Edwards states that when wet, the hair shows minute rainbow reflections as in the desmans, and certain other insectivores.

The skull has been sufficiently characterized in the generic description, and is chiefly notable for its flattened and broadened brain case, and the rather slender first incisors succeeded by long-crowned narrow unicuspids with prominent central cusp and, in the lower canine and premolar, with minute secondary cusps.

Measurements:—The measurements of the type specimen are given by Milne-Edwards as follows: total length, 190 mm.; tail, 100; hind foot, 25; fore foot, 16. Skull, greatest length, 25 mm.; width of brain case, 15.

Occurrence and Habits:—This beautiful water shrew was one of Père Armand David's discoveries in the mountainous district of Muping, central Szechwan. He found it along the banks of the impetuous mountain torrents and small streams, into which it plunges and swims with remarkable facility, in pursuit of small fish which apparently form its main diet. It seemed to be not rare though difficult to secure because of its aquatic habits. To procure specimens he found it necessary to dam off sections of small streams in order to find and dig out its burrows. A writer in the Journal of the Bombay Natural History Society even had the experience of capturing one that came for the small fish which he was using as bait while fishing along a mountain stream in India.

This is still a rare species in collections. In addition to the original specimen in the Paris Museum, from Muping, Père David later found it in the mountains of Shensi, near Sianfu, where he resided for three and a half months in the course of his natural-history explorations (David, 1873). More than twenty years later Prince Henri d'Orléans obtained four others in the course of his journey across Yunnan, but the exact localities are not given by Pousargues (1896a, p. 1) who records them. Finally, a single one, agreeing in all respects with the original description, was recorded by De Winton and Styan (1899, p. 573) from Yangliupa in northwestern Szechwan, thus indicating probably its general northwesterly limits. The latter authors also describe as *N. sikhimensis* two specimens from Sikkim, India, which differ in their browner tint, but doubtless should be regarded as a subspecies only.

Specimens examined:—One skin from Yangliupa, northwestern Szechwan (B.M.).

CHAPTER V

ORDER CHIROPTERA

BATS

Bats may be looked upon as highly specialized derivatives from the insectivore group that have developed the power of true flight through the formation of supporting surfaces by the extension of folds of skin between the hind legs and tail, and between the fore and hind limbs, and more particularly through the transformation of the hand into a wing by the lengthening of the four fingers and the stretching of a membrane between them. In habits many are still insectivorous and retain the essential type of insectivorous molar teeth with W-shaped secant ridges and cusps. At the same time others have become frugivorous and have lost this type of dentition and instead have developed teeth modified in various ways for crushing fruit pulp or other vegetable substances. In correlation with the development of flight, the bodily structure has undergone various modifications, such as the reversibility of the hind limbs and the reshaping of the foot and claws into a hook-like structure for hanging up while at rest; the fibula is usually reduced and slender; the ulna likewise becomes thread-like and incomplete distally; various fusions of the vertebræ take place for strengthening the spinal column; the breast muscles become enormous for flight; the proportions of the fingers of the hand are greatly altered, with loss of the claws, except that the thumb retains a short hook-like claw and the first finger may do so. The fur of the wings and supporting membranes also tends to be lost, from the former altogether, and from the membranes in great part. The group as represented by the living members consists of some seventeen families and is usually regarded as comprising two suborders, the Megachiroptera constituted by the family Pteropidæ or fruit bats, and the Microchiroptera including the remaining sixteen families whose members are for the most part insectivorous, although many have become frugivorous or have developed other special food habits. The Pteropidæ are exclusively Old World in distribution, confined almost altogether to the tropical and subtropical regions, although one species occurs in Japan and another even in the Bonin Islands. On the mainland the family barely reaches

the southern border of China, where it is at present known by two genera only. Of the Microchiroptera, six families are represented, of which the Vespertilionidæ contains the most species. The following key, based in part on Miller's synopsis of the families and genera of bats, will serve for their diagnosis.

KEY TO THE FAMILIES OF CHINESE AND MONGOLIAN CHIROPTERA

A. Larger species, index finger with three phalanges, the last with a claw; ear simple, oval and tubular, without development of the tragus; humerus with the outer supplementary head little developed and not articulating with the scapula..... Megachiroptera (Pteropidæ)

B. Smaller species, index finger never clawed, and its terminal joint lost; ears largely developed, the lower portion expanded and curved forward, but not completely encircling the opening, the tragus usually well developed; humerus with the outer supplementary head large and usually articulating with the scapula... Microchiroptera

a. Muzzle with conspicuous leaf-like outgrowths.

a′. Tragus present, bifid; nose-leaves simple..... Megadermidæ

b′. Tragus absent; nose-leaves more complex.

1. Hind toes with two phalanges each; nose-leaves consisting of a flat horseshoe-shaped leaf on the muzzle, with an erect transverse ridge behind, divided more or less into three parts..... Hipposideridæ

2. Hind toes with three phalanges each; nose-leaves consisting of a flat horseshoe in front, a narrow erect and fleshy connecting piece, and a terminal pointed leaf.. Rhinolophidæ

b. Muzzle without conspicuous leaf-like outgrowths.

a′. The tail tip conspicuously free from the interfemoral membrane.

1. Second finger without phalanges; tail perforating the upper side of the membrane; postorbital processes present in the skull..... Emballonuridæ

2. Second finger with one small phalanx; tail projecting from the posterior border of the interfemoral membrane; no postorbital processes..... Molossidæ

b′. The tail tip not conspicuously projecting beyond the interfemoral membrane..... Vespertilionidæ

Family PTEROPIDÆ

FRUIT BATS OR FLYING FOXES

In this, the only family of the suborder Megachiroptera, the obvious external characters lie in the less reduction of the wing bones, in that the second digit usually has a claw and retains all three of its phalanges, although they are small; further, the ears are elongate and oval, their bases forming a closed tube without the development of the tragus, seen in the Microchiroptera, while

the tail is usually very small and partly free from the interfemoral membranes, which themselves are reduced to narrow borders stretched by the short calcanea. When at rest, hanging by the feet, the head is not turned dorsally when the animal looks about, but faces forward, with the eyes looking to the front. In the skeletal structure the shoulder joint is less complex, lacking a secondary articulation by means of the outer supplementary head of the humerus with the scapula. The skull has well-developed postorbital processes; the premaxillary is generally free and lacks the palatal branch, while the cheek teeth, both upper and lower, are nearly similar in shape, the molars having two blunt cusps on their anterior end, the protocone and paracone in the upper teeth, protoconid and metaconid in the lower. Two genera are known to reach southern China, which is close to the northern limit of their distribution on the mainland.

KEY TO THE GENERA OF CHINESE PTEROPIDÆ

A. Size smaller, forearm less than 90 mm.; tail present but very short.
   a. Back of skull so little deflected downward that the alveolar line, if projected backward, falls outside the skull; cheek teeth four above, five below, back of canine..... *Cynopterus*
   b. Back of skull so deflected downward that the alveolar line, if projected backward, passes through the root of the zygoma; cheek teeth five above, six below, back of canine..... *Rousettus*

B. Size larger, forearm more than 90 mm.; tail absent; back of skull so deflected that the alveolar line, if projected backward, passes through the zygoma.... *Pteropus*

[*Pteropus chinensis* Gray:—In 1870, Dr. J. E. Gray (1870, p. 111) described under this name a bat which he supposed came from northern China. As explained by Andersen (1912, p. 315), this specimen was received from Robert Fortune, a collector of plants, who traveled in the northern provinces of China in 1843-45. His specimen appears to have been without label, but was assumed by Gray to have come from that country and so was named *P. chinensis*. But Andersen points out that Fortune, previous to his visit to China, had also been in the Philippines, and since the type of *P. chinensis* "differs in no noteworthy character from that of *Pt. leucopterus* [of the Philippines] there can be no reasonable doubt that it was obtained by Fortune during his stay in Luzon."]

[*Pteropus formosus* P. L. Sclater:—According to Mell (1922, p. 13) there is in the City Hall Museum at Hongkong, a specimen of this Formosan species labeled merely "15 XII 1899, Ford." Mell states that Ford had been Director of the Hongkong Botanical Garden since 1871, so that presumably the specimen was from near that city. That it might have been sent or brought from Formosa by persons coming from that island seems equally probable and much more likely than that it was a waif, borne by storms or in a trading vessel. It

should, therefore, await more certain evidence before being admitted as a Chinese species.]

The rejection of these two records leaves no member of the genus *Pteropus* as definitely known to occur in China. The presence of the closely allied *P. formosus* and *P. dasymallus* in Formosa and Japan respectively, and of *P. pselaphon*, an ally of the Philippine *P. leucopterus*, in the Bonin Islands, and the entire absence of the genus from the mainland of China, so far as at present known, may be in part a result of an older distribution when higher temperatures prevailed to the northward, and in part a result of the mollifying effect of the warm Japanese current making it possible for these species to subsist in such outlying regions.

Genus **Cynopterus** F. Cuvier

Cynopterus F. Cuvier, Dents des Mammifères, p. 248, 1825.

The fruit bats of this genus are of medium size, with stout heavy bodies and short snouts. The nostrils are prominent, almost tubular; the second finger has a well-developed claw; the tail, though very short, is present, and its tip projects beyond the narrow interfemoral membrane. The calcaneum, as usual in the group, is short, about equaling the width of the hind foot, and serves to extend the narrow interfemoral membrane. In the skull the rostrum is short, the postorbital processes well developed, and the occiput so little bent that the line of the alveoli, if projected backward, passes through the upper part of the audital bullæ and occipital condyles. The four upper incisors form a transverse row and are all in contact with one another, but are separated from the canine by a short space. The canines, both upper and lower, have a small secondary cingulum cusp on the inner side. The first premolar is small, the upper smaller than the lower; the second is the largest in both jaws; the molars (one above and two below) are smallest in descending series. The crowns of these larger teeth are simple, with an inner and an outer ridge and a groove between, suitable for frugivorous habits. The tooth formula is: i.$\frac{2}{2}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{2}{2}$ = 30. The palate has ten or twelve thick crescentic cross-ridges between the tooth rows.

Andersen (1912) recognizes sixteen forms representing six species distributed across the oriental region from the Indian peninsula and Ceylon, north to Sind, Nepal, Siam and east to Hainan, thence southward and eastward to Borneo, Celebes, and the Philippines. Two species seem to occur in China, one of which, *Cynopterus sphinx*, is the type of the genus.

62. **Cynopterus sphinx sphinx** (Vahl)

Vespertilio sphinx Vahl, Skrift. Naturh. Selsk. Copenhagen, vol. 4, pt. 1, p. 123, 1797.
Cynopterus sphinx sphinx Andersen, Cat. Chiroptera British Mus., vol. 1, p. 598, 1912 (full synonymy).

Type specimen:—According to Andersen (1912, p. 602), the two original

specimens from Tranquebar, Madras, India, on which the species was based, were formerly in the collection of the Copenhagen Natural History Society, and were probably transferred to the newly founded Royal Natural History Museum in 1804. Doubtless, however, they were destroyed with many other mounted skins through defective preservation in the years following.

Description:—A stout-bodied olive-brown bat, with the flanks and sides of the neck bright tawny.

Top of head, back, forearms, and basal part of the interfemoral olive brown, the neck region more or less tawny-russet, which on the sides of the neck becomes cinnamon rufous, forming a half-collar, and on the flanks pales into a slightly lighter shade again. The center of the belly is drab. Ears naked, black with conspicuous narrow white edges. Membranes dark, blackish, the phalanges of the fingers contrastingly pale whitish. On the under side the fur extends out on the membrane slightly less than half-way between the elbow and the wrist. Females usually have the tawny shades paler than the males, and young specimens lack them almost wholly, being dull olive brown or slaty brown, paler or darker drab below.

The skull in these bats is readily recognizable by the very slight deflection of the posterior part, so that the line of the alveoli of the teeth if continued backward would fall outside the skull. The short deep rostrum is a conspicuous character, the distance from the orbit to the nostril opening usually slightly exceeding one-fourth the length of the skull.

Measurements:—The forearm measurement varies, according to Andersen (1912, p. 634), from 66-73.5 mm.; the tail from 10-13; the tibia from 25-27.5; the foot from 16-18.5.

CRANIAL MEASUREMENTS OF *CYNOPTERUS SPHINX*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Sex	Locality
58433	31.5	27.6	16.2	20.0	13.0	10.0	11.0	12.0	♂	Hainan
58438	31.0	27.2	16.0	20.3	13.3	9.5	10.2	11.7	♀	Hainan
58443	31.7	28.0	16.1	20.4	13.1	9.8	10.9	11.5	♂	Hainan
58436	32.8	29.0	17.0	21.8	13.5	10.2	11.1	12.3	♂	Hainan
58410	32.0	28.8	16.5	21.4	13.0	9.3	10.9	12.2	♂	Hainan
58441	31.5	28.0	15.8	20.0	12.4	9.5	10.3	11.8	♂	Hainan
58422	31.0	28.0	16.2	19.8	12.3	9.6	11.1	12.5	♂	Hainan
58417	31.8	28.2	16.5	20.3	12.8	9.5	11.1	12.0	♀	Hainan
58439	31.3	28.2	16.2	20.0	12.6	9.1	10.6	11.9	♀	Hainan
58431	31.8	27.8	16.4	20.2	13.0	9.0	11.0	11.9	♀	Hainan
58346	31.1	27.7	16.0	20.3	12.5	9.2	10.8	12.2	♀	Hainan

From the above table it is clear that males and females average almost exactly the same in cranial dimensions.

Occurrence and Habits:—This is the larger species of *Cynopterus* found over most of India, Assam, Burma, and Siam, and is represented by a slightly larger race on the islands of Sumatra and Java. Its presence on the mainland of China has not been detected, although it must eventually be found along the extreme southern border, and doubtless in southwestern Yunnan, for Andersen records it from just across the border in Burma at Bhamo and the Kakhyen Hills. The credit for its actual discovery in China is due to Mr. Clifford H. Pope, who in December, 1922, and January, 1923, found it abundant at Nodoa, Hainan, during the season of the year when the chinaberry trees are in fruit. Between December 4 and January 23, he secured a series of thirty-six specimens in that vicinity. He writes: "December 9th. This morning I secured several bats of a species new to our growing collection. They were found hanging in bunches of three or four on the under side of palm leaves, twelve or fourteen feet above the ground, and in places not in the least dark, where they were shaded only by the hanging ends of the leaves.

"When the fruit of the Chinaberry tree, sometimes called the Pride of India, was well developed these big bats became a nuisance. Every evening about nine o'clock they would come out in numbers to feed on these fruits. All through the night Chinaberry seeds could be heard dropping on nearly every porch in the compound, and the following morning the porches would have piles of the seeds on them. A bat after picking some fruit, would fly to a porch, hang there from a nail or some projection of the under side of the roof, and proceed to feast, rejecting the seeds, most of which would be found in little piles, showing that the bats had favorite projections and nails, and thus night after night would litter the same places. If surprised at his feast the bat would quickly fly off.

"We often found these bats hanging under the palm leaves but never more than seven or eight together. As long as the Chinaberries lasted, these big bats were always in evidence. After the fruiting season was over, however, they disappeared and in the course of a two months' stay thereafter were not seen at all" (Pope, in MS.).

No doubt the seasonal abundance varies, as Mr. Pope's notes indicate, according to the fruiting season of particular trees, and the remarkable thing is that they arrive in numbers at the proper time. This habit perhaps accounts for the fact that Swinhoe and later collectors in Hainan failed to find this bat.

Specimens examined:—In all, thirty-six, from Nodoa, Hainan.

63. **Cynopterus brachyotis angulatus** Miller

Cynopterus angulatus Miller, Proc. Acad. Nat. Sci. Philadelphia, 1898, p. 316.
Cynopterus brachyotis angulatus Andersen, Cat. Chiroptera British Mus., vol. 1, p. 611, 1912.

Type specimen:—A male in alcohol, No. 83569, U. S. National Museum, from Trong, lower Siam.

Description:—Similar in size and coloring to *C. sphinx* with which it occurs over part of its range, but the ear is smaller and the rostrum shorter, so that the distance from the orbit to the nasal opening is less than, instead of equaling, one fourth of the total length of the skull. The same sexual and age differences in color are found in this species as in *C. sphinx*.

Measurements:—No Chinese specimens are available for measurement, but Andersen (1912, p. 634) gives the following dimensions: forearm, 65-72 mm.; ear from orifice, 16-18, instead of 18-20 as in *C. sphinx*; tail, 8.5-11.5; foot with claws, 15-17.5; tibia, 23.5-27.5.

The skull measures: greatest length, 30.5-33.2; basal length, 29.5-32; palatal length, 11.0-12.8; rostrum, 6.5-8.2; zygomatic width, 19.8-21.8; upper cheek teeth, crowns, 10.2-11.3; lower cheek teeth, crowns, 11.1-12.8.

Occurrence and Habits:—This is the largest of the several races of the species and occurs over a wide area from Assam, Upper Burma, and northern Siam, southward in the Malay Peninsula, to Sumatra and the neighboring islands. Its presence in China is, therefore, not unexpected, and it will probably be found to reach the extreme southern border. The only actual record for China is that of Mell (1922), who states that it is common in the southern part of the Canton region, as at Logong, Lofau Shan, and Dingwu Shan, as well as on the East River (Ho Yün), but in the northern part of this area he had but one instance, at Jann-fah.

Mell states that in March and April it feeds on the large fleshy flowers of *Bombax malabaricum*, and in doing so knocks off to the ground from a half to four-fifths of the heavy blood-red flower heads. In June it becomes a well-known pest to the "laitsi" growers, and at that season is often captured in nets placed vertically about these trees. In September and October, they feed on the fruit of a species of fig, *Ficus retusa*. During the day they hide in thick or hollow trees, and on one occasion he found one resting behind a beam in a room. They are always awake by day, their eyes open, and are ready to fly away at once if disturbed. Mell believes that they are crepuscular and sleep during part of the night. They are of a restless and vicious temperament. Captives will eat at dusk such soft-skinned fruits as banana and persimmon, as well as the laitsi and lungan fruits. A dozen females that he found in late June and early July had each a small young one close under the wing. The young apparently change from one teat to the other, for two young, though occasional,

are the exception. One female caught in a tree net was said to have had two young. These bats, Mell adds, are eaten by the Chinese as they believe them "strengthgiving."

Specimens examined:—None.

Genus **Rousettus** Gray

Rousettus Gray, London Medical Repository, vol. 15, p. 299, 1821.

Bats of this genus somewhat resemble *Cynopterus* externally but are more nearly a uniform smoky brown than olive in color. The size, however, is much the same. In cranial characters the skull of *Rousettus* differs in the slightly greater deflection of the posterior part, so that the alveolar line if projected backward passes through the condyles or through the base of the zygoma; in addition, the rostrum is less shortened, so that the distance from the edge of the orbit to the nares is greater than the lachrymal width. In its teeth it much resembles *Cynopterus*, but the cusps, ridges and grooves are less strongly developed. The tooth formula differs in that there is one more molar in each jaw both above and below, namely: $i.\frac{2}{2}$ $c.\frac{1}{1}$ $pm.\frac{3}{3}$ $m.\frac{2}{3} = 34$. The genotype is *Rousettus ægyptiacus*.

This genus barely reaches the extreme southern borders of China, for its distribution is tropical and subtropical. A single species has been once recorded.

64. **Rousettus leschenaulti** (Desmarest)

LESCHENAULT'S ROUSSETTE BAT

Pteropus leschenaulti Desmarest, Encyclop. Méthod., Mamm., vol. 1, p. 110, no. 142, 1820.
Cynonycteris amplexicaudata Swinhoe, Proc. Zool. Soc. London, 1870, p. 616.

Type specimens:—According to Andersen (1912, p. 37), the two cotypes of this species are still in existence in the mounted collection of the Muséum d'Histoire Naturelle at Paris, and are labeled as from "les environs de Pondichéry," India, collected by Leschenault previous to 1820.

Description:—A fairly large bat, forearm 80.5-87.5 mm., with the general appearance of the other Chinese fruit bats, *Cynopterus*, but the color of the fur browner instead of olive, the back and rump dark, dull brown, crown and occiput brownish bister, the nape varying from light drab to almost wood brown; under side between drab and isabella color. There is also a considerably brighter phase, with the back and rump Mars brown, the under side wood brown (Andersen, 1912, p. 37).

The longer rostrum and the slightly more deflected brain case distinguish the skull from that of *Cynopterus*, and the teeth are one more in each jaw, as noted under the generic diagnosis.

Measurements:—Andersen gives the following measurements: forearm, 80.5-87.5 mm.; tail, 13-17.5; foot with claws, 20-23.5. The skull measures: greatest length, 37.5-41.5 mm.; orbit to tip of nasals, 12.8-13.5; zygomatic width, 22.8-23.7; width outside molars, 11-12; upper cheek teeth, 14-15.7; lower cheek teeth, 15.2-17.

Occurrence and Habits:—The only evidence for the inclusion of this species in the Chinese list is furnished by the following records. Swinhoe (1870, p. 616) reported that in May, 1866, a female *Cynonycteris amplexicaudata* was brought to him at Amoy, dead, but with a still-living young one clinging to her. Andersen (1912, p. 35) regards this record as referring to the species in question. It is corroborated by a second instance mentioned by Mell (1922, p. 13), of a specimen in the City Hall Museum at Canton, labeled as from Hongkong, and dated June 9, 1876. The species evidently, therefore, occasionally reaches the extreme southern border of China, and is of course well known in India, southern Burma and Siam.

Specimens examined:—None.

Family EMBALLONURIDÆ

SHEATH-TAILED BATS

In this family, according to Miller (1907), are combined the greatest number of primitive characters, together with the least degree of specialization of any of the Chinese Microchiroptera. In the shoulder joint, the supplementary inner and outer heads of the humerus are slightly developed, and the latter does not articulate with the scapula; the teeth are typically those of insectivorous bats, the premaxillary bones are not fused to the maxillaries, the tragus is present but simple, the fibula is slender but complete, while in the skull the postorbital processes are large and well developed. Externally, in addition to the fact that the slender and rather short tail projects conspicuously on the upper surface of the interfemoral membrane slightly back from its edge, the bats of this family may be at once recognized by the peculiar manner of folding the wing, so that when at rest the inner of the two phalanges of the third finger is folded back on the upper side. The family is represented in the tropical parts of both Old and New Worlds, and by only a single genus, *Taphozous*, in China. Although two species are recorded from the country, one of these appears to be of doubtful origin, while the other is apparently for the first time here reported.

Genus **Taphozous** Geoffroy

Taphozous Geoffroy, Description de l'Egypte, vol. 2, p. 113, 1818.

The bats of this genus are large or of medium size, with large erect ears,

a short squarish tragus, long tapering muzzle, and the lower lip terminating in two bare areas separated by a groove; the feet are rather slender, and the very long calcar spreads the short interfemoral membrane, from the upper surface of which the slender tail projects. In the skull the forehead is distinctly hollowed, the postorbital processes are well developed, narrow, and in the lower jaw there is a conspicuous incurving of the lower margin beneath the premolars; the premaxillary bones are small and free, carrying each a minute incisor; the strong canines have a conspicuous cingulum which develops a small basal cusp at the anterior and posterior ends of the tooth; in the first and second upper molars the W-pattern of cusps and ridges is well marked, but the hypocones are lacking, while the third upper molar is reduced, consisting of the two anterior commissures and the mesostyle only. The formula is: $i.\frac{1}{2}$ $c.\frac{1}{1}$ $pm.\frac{2}{2}$ $m.\frac{3}{3} = 30$.

The genotype is *Taphozous perforatus* of Egypt.

The genus is typically an inhabitant of warm countries, tropical and subtropical, barely reaching the southern border of China, unless Hollister's record of it from Peiping proves to be well founded.

65. **Taphozous melanopogon** Temminck

BLACK-BEARDED FREE-TAILED BAT

Taphozous melanopogon Temminck, Monogr. de Mammalogie, vol. 2, p. 287, 1835.

Type specimen:—Presumably in the Leiden Museum; from Java.

Description:—On the upper side the fur is confined to the head and body, not extending out on to the membranes or to the limbs, but on the lower surface it extends out on the membranes as far as a line joining the elbow and the middle of the femur. The general color of the fur both above and below is a dull brown (about "mummy brown" of Ridgway), the bases of the hairs everywhere dull white, which shows through on the throat, and if the hair is parted, on other portions of the body. At the chin is a small tuft of all-black hairs, whence the specific name.

The skull, in addition to the general characters already mentioned, is notable for the large oval brain case with a nearly vertical posterior wall and the hollowed forehead. The large canines are long, slender and nearly vertical, followed by a very small premolar with a narrow knife-like edge, and the large premolar with its main cusp nearly reaching the level of the tip of the canine, making a conspicuous space between the two. The "basial" pits between the ear conchs are large and deep with a distinct narrow partition in the midline.

Measurements:—The collector's measurements of four Yunnan specimens follow:

No.	Total length	Tail	Hind foot	Ear	Expanse of wings
85012	110	25	13	21.5	405
85014	100	23	12	21.0	391
85015	105	24	13	21.0	391
85016	110	25	14	21.0	410

The skulls of these specimens measure:

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Sex	Locality
85014	22.2	——	8.8	12.8	——	8.9	9.0	10.0	♂	Yunnan
85015	22.0	18.4	8.8	13.0	11.3	8.9	9.0	10.0	♀	Yunnan
85016	22.0	19.8	9.0	13.0	11.6	9.3	9.0	10.0	♂	Yunnan
85012	22.3	19.0	8.9	13.0	11.4	9.0	9.0	10.3	♂	Yunnan

Occurrence and Habits:—This is a widely distributed species over much of tropical India and parts of the Malay Peninsula, although Thomas has described as a subspecies, *T. m. fretensis*, the bat from the Strait of Malacca, whose range, therefore, intervenes between that of typical *T. melanopogon* of Java and the continental form supposedly the same. It is represented in the collections of the Central Asiatic Expeditions by four skins and three alcoholic specimens from Yuankiang, in southern Yunnan. These appear to be the first recorded Chinese examples and add another to the list of those tropical and subtropical species the northern border of whose range includes southern China. Since in its general range this genus and even the family is characteristically tropical in distribution, it is rather astonishing to find it recorded from Peiping, in North China, whence Hollister (1913a, p. 157) has described *Taphozous solifer* on the basis of alcoholic material collected for the U. S. National Museum by M. L. Robb in 1901. However, since this bat has the "size, proportions, and general characters of *Taphozous philippinensis*" and on account of the tropical distribution of the group is unlikely to have come from so far into the temperate zone as Peiping, I cannot help feeling that there must have been some mistake about the locality, and that Hollister was led to describe it more on account of its apparently outlying distribution than from any marked difference. Until more positive evidence is discovered establishing the occurrence of *Taphozous* in North China, I therefore prefer to regard this as an erroneous record, and to believe that the specimens really came from some more tropical locality, perhaps in the Philippine group. Hollister's description follows:

Type:—An adult male in alcohol, No. 113,010, U. S. National Museum. Collected March 28, 1901, by M. L. Robb.

"*Diagnosis:*—Size, proportions, and general characters of *Taphozous philippinensis*. Color quite different; upperparts with underfur drab instead of white, and with hair tips and general color much paler; lower underparts with hairs uniformly drab-gray, not bicolor.

"*Color* from alcoholic specimens:—General color of upperparts wood-brown, the underfur drab and the hair tips wood-brown. Middle of throat, including beard and stripe under and back of ear, blackish. Cheeks, sides, and belly drab-gray, the hairs unicolor.

"*Skull and teeth:*—Skull almost precisely as in *T. philippinensis*. Teeth slightly smaller, the mandibular rows noticeably narrower.

"*Measurements of type* from alcoholic:—Head and body, 76; tail vertebræ, 21; hind foot, with claws, 12; forearm, 64. Skull of topotype: Condylobasal length, 19.4; zygomatic breadth, 12.5; breadth of braincase, 10.4; mastoid breadth, 10.9; interorbital breadth, 5.7; postorbital breadth, 4.8; upper tooth row, entire, 9.1; mandible, 16.4; mandibular tooth row, entire, 11.1."

Specimens examined:—In all, seven, four skins and skulls, three in alcohol, from Yuankiang, Yunnan.

Family MEGADERMIDÆ

BIG-EARED BATS

This family is confined to the tropical and subtropical parts of Australia, Asia and Africa, and its members may be recognized externally by the presence of a simple leaf-like outgrowth erect on the nose, by their large oval ears, and the possession of but a single phalanx in the second finger. The tragus is also characteristic in being bifid, with a short anterior division and a long and slender posterior one. In the skeleton, the two supplementary heads of the humerus, trochiter and trochin, are small, of nearly equal size, and lack articulation with the scapula; the third finger has but two phalanges, the second but one; the very wide presternum is fused with the first rib and the first dorsal and seventh cervical vertebræ, making a solid bony ring; the fibula is slender, and imperfect at its proximal end; the ischia of the pelvis are free posteriorly (Miller, 1907, p. 102). In the skull the most marked peculiarity is the entire loss of the premaxillaries.

So far as at present known, the family is represented in China by only a single genus, *Lyroderma*.

Genus **Lyroderma** Peters

Lyroderma Peters, Monatsb. Kön. Preuss. Akad. Wiss. Berlin, 1872, p. 195 (as a subgenus of *Megaderma*). Miller, Bull. U. S. Nat. Mus., no. 57, p. 104, 1907 (valid genus).
Megaderma Geoffroy, Ann. Mus. d'Hist. Nat., Paris, vol. 15, p. 197, 1810 (in part).
Eucheira Hodgson, Journ. Asiatic Soc. Bengal, vol. 16, p. 891, 1847 (preoccupied by *Eucheira* Westwood, 1836, for a genus of insects). Andersen and Wroughton, Ann. Mag. Nat. Hist., ser. 7, vol. 19, p. 134, 1907.

This genus is very close to *Megaderma* of India and Malaysia, but is distinguished by the strong supraorbital ridges which terminate in short projections as "incipient postorbital processes" and increase the width of the frontal region so that the lachrymal width is greater instead of less than the distance from orbit to canine. The teeth differ in that the upper molars are still more aberrant through the reduction of the mesostyle and the elongation of the outer posterior corner (metastyle), thus distorting the W-pattern of the outer half of the tooth so that the two parts of the W are no longer subequal, but the posterior part is much drawn out and the hind margin much concave. The loss of the upper incisors is partly made up by the development of a small cingulum cusp at the anterior base of the canine, while at its posterior base is a similar cusp and a large basal cusp; the anterior upper premolar is minute, hidden in the angle between the canine and large premolar, which are in contact. The lower jaw has two minute incisors on each side, with trifid crowns; the canine has a prominent antero-internal basal cusp; and the two premolars are large and triangular in profile, the anterior slightly larger than the posterior. The formula is: i.$\frac{0}{2}$ c.$\frac{1}{1}$ pm.$\frac{2}{2}$ m.$\frac{3}{3}$ = 28. A single species only is found in China. The type species is *Lyroderma lyra* of India.

66. **Lyroderma lyra sinensis** (Andersen and Wroughton)

CHINESE VAMPIRE OR BIG-EARED BAT

Eucheira sinensis Andersen and Wroughton, Ann. Mag. Nat. Hist., ser. 7, vol. 19, p. 136, 1907.
Megaderma lyra Swinhoe, Proc. Zool. Soc. London, 1870, p. 616 (not of Geoffroy).
Megaderma spasma Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 9, p. 1, 1930 (not of Linnæus).
Lyroderma lyra sinensis Sanborn, Proc. Biol. Soc. Washington, vol. 46, p. 55, 1933.

Type specimen:—A skin and skull, No. 7.1.1.339, British Museum, from Amoy, Fukien, China. Tomes Collection.

Description:—Ears large, oval, joined across the forehead at their bases, naked except for a line of fine minute hairs along the inner edge and on a rib running just inside the inner margin. Nose-leaf an erect oval leaf about 10 mm. high in the dry skin, minutely hairy. General color of body above, from nape to tail mouse gray washed with "wood brown"; face light gray; lower surface paler, the hairs with dark-gray bases and grayish-white tips. The basal joint of the thumb is included in the membrane of the wing; the second joint of the third finger is very long, equaling the third metacarpal, and is pale

in color along the bone. The tibia is unusually long, more than half the length of the forearm.

The skull is at once distinguished among Chinese bats by the absence of the premaxillaries.

Measurements:—The forearm measures 67 and 65 mm. in two skins from Futsing; the third metacarpal, 47, 51; its first phalanx, 30, 28; second phalanx, 55, 49.5; tibia, 37, 33; foot, 20, 19.5.

CRANIAL MEASUREMENTS OF *LYRODERMA LYRA SINENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Width across molars	Mastoid width	Upper tooth row	Lower tooth row	Locality
33126	30.0	24.0	12.0	16.7	10.0	13.0	11.2	13.0	Fukien
33129	30.8	24.8	12.2	17.0	10.1	13.0	11.7	13.5	Fukien

Occurrence and Habits:—This species of the more torrid parts of southeastern Asia, reaches the southern portion of China, ranging northward along the coast as far at least as northern Fukien, and perhaps to about the same latitude in the central part of China. It was first mentioned from the country by Swinhoe (1870c, p. 616) who recorded as *Megaderma lyra* a pair captured in an outhouse at Amoy. It may have been one of this pair that was later acquired by Tomes and came with his collection of bats to the British Museum, eventually serving as the type of the subspecies. Swinhoe believed also that other bats he saw hawking high over the city of Amoy were of this species, but quite as likely they were *Taphozous*, which has this habit. In the collection of the American Museum of Natural History is a series of some twelve specimens, taken at Futsing, Fukien, by Paul D. Bergen, which mark apparently the most northerly station yet known for the species. Farther south, at Swatow, Kwangtung, Andersen and Wroughton record a single specimen in the collection of the British Museum. The first inland record seems to be the recent one of Shih (1930b, p. 1), who secured two males and a female from the southwestern border of Hunan, apparently from the limestone caves at Yuen Shan. Under the name *Megaderma spasma*, he writes that "the record of so southern and tropical a form in a temperate district is remarkable," but I think that his specimens must have been this species instead.

More recently Sanborn (1933) has recorded a series of thirty-five taken at Yachowfu (lat. 29° 20′ north), in western Szechwan, the first to be discovered in western China. These average very slightly larger in the forearm measurement and are described as "much lighter in color, being decidedly brown instead of grayish-brown" as compared with the Fukien series. The species is evidently to be looked for all across the southern part of China, for while there seems to be no evidence as yet of its presence in Yunnan, its occurrence there is to be expected. The curious food habits of the related Indian species are

well known, and probably like it this bat feeds upon other vertebrates, including birds, small mammals, and frogs.

Specimens examined:—Twelve, from Futsing, Fukien.

Family RHINOLOPHIDÆ

LEAF-NOSED BATS

Bats of this group are easily distinguished in external appearance by the peculiarities of the ears and the more or less complex leaf-like outgrowths of the muzzle. The ears are proportionally large, but the size is apparent not in their length but in their breadth, with a wide conch which narrows rather quickly toward an acute tip. There is no tragus. In these respects they resemble the Hipposideridæ, but the formation of the nose-leaves is different. In the Rhinolophidæ, these consist of a flat horseshoe-shaped leaf, sometimes with supplementary and smaller lateral leaves; in the central part of the large leaf open the nostrils, enclosing between them a small median cup-shaped section, which rises behind these openings as an erect and somewhat parallel-sided column (the "sella"), its flat face directed forward; its posterior side is buttressed by a low compressed ridge, the "connecting piece," which continues back into the median pointed terminal leaf, the "lancet," whose base is formed by the incurved walls of the horseshoe. The Hipposideridæ lack this development of the central column and the single median leaf, but instead the posterior wall is erect, and divided into three nearly equal compartments by vertical ridges. Other external peculiarities are: the normal toes, with three joints each except on the first digit; the second digit of the wing consisting of the metacarpal only; the third finger of the wing with only two phalanges; and the rather short tail. The outer supplementary head of the humerus has a distinct articulation with the scapula; the seventh cervical and the first dorsal vertebræ are solidly fused together and to the first rib and presternum, making a strong ring of bone at the anterior part of the thorax. The fibula, though slender and thread-like, is complete. The skull is peculiar in lacking postorbital processes, and in the reduction of the premaxillaries, so that they consist of the narrow palatal branches only, both separate from each other and from the surrounding bones, and bearing a single minute tooth. The palate is very short in the median line, on account of deep indentations at both ends. (For other details see Miller, 1907.)

This family is exclusively confined to the Old World, chiefly in the warmer portions, from southern Europe to China and eastward to the Philippines, New Guinea, and Australia. About a dozen species have been found in China, with various local races. All are members of the single genus *Rhinolophus* which constitutes the family, so that the generic characters are those of the family as well.

Genus **Rhinolophus** Lacépède

Rhinolophus Lacépède, Tableau des div., sousdiv., ordres et genres des Mammifères, p. 15, 1799.

In addition to the family characters mentioned, the presence of three lower premolars distinguishes this group of bats from the related family Hipposideridæ. The tooth formula is: i.$\frac{1}{2}$ c.$\frac{1}{1}$ pm.$\frac{2}{3}$ m.$\frac{3}{3}$ = 32. The minute upper incisors have bluntly rounded tips, but the crowns of the lower are trifid, the outer larger than the inner, and all forming a continuous row between the canines, which are simple. The first upper and second lower premolars are very small reduced teeth, usually crowded more or less completely out of the tooth row, and practically functionless. The first and second upper molars show the typical W-shaped pattern of cusps, but the third is reduced in size.

Andersen in various articles has reviewed briefly the species of this family, giving descriptions and short diagnoses. In his paper of 1905 (Proc. Zool. Soc. London, vol. 2, pp. 75-145), he recognizes three or four larger groups, into which most of the Chinese species fall. The least specialized of these is the *R. simplex*, later called the *R. megaphyllus*, group, in which the connecting piece of the erect portion of the nose-leaf is low and rounded, hardly projecting above its level, and with the basioccipital not specially narrowed between the cochleæ of the ears; a second group is more evolved with the connecting piece produced upward in a more or less narrowed point, and with normal basioccipital as in the *R. simplex* group: the *R. lepidus* group. A third group, the *R. midas* group, has the connecting process low as in the first group, but the cochleæ of the ears are greatly enlarged, making the basioccipital between them very narrow or linear. This group is apparently unrepresented in China. Two other groups, typified by *R. macrotis* and *R. philippinensis*, have been found to occur in China. The type species of the genus is the European *R. ferrum-equinum*.

Key to Chinese Species of *Rhinolophus*

A. Connecting process coming off from nearly the level of the summit of the sella.
  a. Connecting process in side view low and broadly rounded off..... (*R. megaphyllus* or *R. "simplex"* group)

    a′. Sella in front view parallel-sided; second phalanx of third digit not more than one and one-half times the first.
      a″. Larger, forearm about 46 mm..... *R. rouxi sinicus*
    b′. Sella in front view pandurate (sides slightly concave); second phalanx of third digit more than one and one-half times the first.
      a″. Small p^2 in the tooth row, palatal bridge less than one-third the maxillary tooth row *R. affinis* subsp.

b″. Small p^2 external to the tooth row or wanting, palatal bridge more than one-third the maxillary row..... *R. ferrum-equinum* subsp.

b. Connecting process in side view erect and sharply pointed..... (*R. pusillus* or *R. "lepidus"* group)

a′. Larger, forearm more than 38 mm.

a″. Forearm about 42 mm..... *R. lepidus*

b″. Forearm about 39 mm..... *R. cornutus pumilus*

b′. Smaller, forearm about 37 mm..... *R. blythi szechwanus*

B. Connecting process coming off well below the summit of the sella.

a. Sella narrowing towards the summit, without cup-like or wing-like expansions at its base; palatal bridge less than one-third the length of maxillary tooth row..... *R. pearsonii* and *R. p. chinensis*

b. Sella broad, its basal margin raised, cup-like, or expanded, wing-like.

a′. Base of the sella raised and cup-like in front, its face hairy..... *R. episcopus episcopus* and *R. e. caldwelli*

b′. Base of sella expanded wing-like.

a″. Fur woolly, dark, forearm 71-72 mm..... *R. lanosus* and *R. l. spurcus*

b″. Fur normal, forearm about 55 mm..... *R. rex*

67. **Rhinolophus rouxi sinicus** Andersen

Rhinolophus rouxi sinicus Andersen, Proc. Zool. Soc. London, 1905, vol. 2, p. 98.
Rhinolophus rouxi De Winton and Styan, Proc. Zool. Soc. London, 1899, p. 573 (in part).

Type specimen:—Adult male, skin and skull, No. 99.3.1.6, British Museum, from Chinteh, Anhwei, China. Collected by F. W. Styan.

Description:—This bat is easily recognized by the combination of the following characters: (1) in the wing, the more primitive structure is maintained wherein the second phalanx of the third finger is not lengthened and so does not exceed one and one-half times the first; (2) there is a distinct supplementary leaflet external to the horseshoe at the sides of the muzzle; the sella in front view is narrow and parallel-sided instead of pandurate, with its summit broadly rounded; the connecting process in side view is low and broadly rounded off, and the lancet is hastate, that is, abruptly narrowed in the middle, with a well-developed, slender tip; (3) the wing membrane is inserted on the leg just above the tarsus; (4) in the skull the palate is relatively unshortened, so that the median length is more than one-fourth of the maxillary tooth row; (5) in the upper jaw, the small premolar (p^2) usually stands distinctly in the tooth row, separating the upper canine and the large premolar, while in the lower jaw the small premolar (p_3) is usually external or rarely half external to the tooth row; (6) the size is less than in the somewhat similar *affinis* group, with obviously

less bulk, so that even if extreme examples approach each other in forearm length, the wing expanse is less than in the latter; the forearm measurement is about 46 mm.

In color the adults are a rich russet brown above with a very indistinct V-shaped area of darker from each shoulder to the lower back; the basal two-thirds of the hairs is pale buffy white; below, similar, but the pale bases of the hairs less extensive except on the throat where they are faintly pinkish buff. The fur is rather short, about 6 mm. The young are smoky gray-brown, scarcely paler at the base of the hairs.

Measurements:—The following measurements of fresh specimens are available, including two measured in the flesh by W. R. Zappey, the collector:

No.	Total length	Tail	Hind foot	Forearm (dry)	Locality
7223 MCZ	75	22	9	45.3	Hupeh
7224 MCZ	69	20	10	44.0	Hupeh
55908	75	25	10	45.0	Szechwan

Andersen (1905e, p. 100) gives the following wing measurements: third metacarpal, 34; first phalanx of same, 14.6; second phalanx, 20.8; fourth metacarpal, 34.7; first phalanx of same, 11.2; second phalanx, 12.3; fifth metacarpal, 35.4; first phalanx of same, 11.9; second phalanx, 11.2.

CRANIAL MEASUREMENTS OF *RHINOLOPHUS ROUXI SINICUS*

No.	Total length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width outside molars	Maxillary tooth row	Mandibular tooth row	Locality
60216	20.2	16.2	6.5	——	9.5	—	7.5	8.0	Fukien
60217	20.2	16.0	5.9	10.5	9.8	—	7.4	8.0	Fukien
60225	19.3	15.4	5.5	10.2	9.5	7.8	7.3	7.9	Fukien

Occurrence and Habits:—This is a common bat over the southern half of China from the Yangtze valley on the east, westward along the lower parts of the Szechwan highlands into southern Yunnan. The type specimen was secured by Styan at Chinteh, Anhwei (De Winton and Styan, 1899, p. 573), although the distinction was not made until six years later. It is common in Fukien, whence series have been obtained from Yenping, by the members of the American Museum Asiatic Expeditions and by collectors for the U. S. National Museum (A. B. Howell, 1929, p. 12); Pope found it common at Chunganhsien in the same province in July, 1926, and A. B. Howell has recorded it from Foochow. Farther south, Mell (1922, p. 13) writes of finding single individuals hanging behind roof beams of houses in both the northern and southern parts of the Canton region. I have already (G. M. Allen, 1912, p. 245) recorded two specimens collected by Zappey at Ichang, Hupeh, while still farther west along the River Yangtze, Dr. Walter Granger obtained a number at Wanhsien, in eastern Szechwan, from the caves in that vicinity.

Another fine series was taken at Likiang, in western Yunnan, by Dr. R. C. Andrews and Edmund Heller. It is to a large extent a social species, but during the season when the females are having their young, they apparently segregate, the males consorting by themselves. Thus, of the series from Chungan taken by Mr. Clifford H. Pope, July 15 and 16, 1926, all the adults were old females, while with them were immature males and females, their progeny, then nearly full grown.

Specimens examined:—In all, one hundred and eight, as follows:

Hupeh: Ichang, 2 (M.C.Z.).
Fukien: Chunganhsien, 20; Yenping, 23; Yungan, 1.
Szechwan: Wanhsien, 7.
Yunnan: Likiang, 54 (including three skins).
Chekiang: Tunglu, 1.

68. **Rhinolophus affinis himalayanus** Andersen

Rhinolophus affinis himalayanus Andersen, Proc. Zool. Soc. London, 1905, vol. 2, p. 103, pl. 3, figs. 11a, b.
Rhinolophus affinis Dobson, Cat. Chiroptera British Mus., p. 112, 1878 (in part).

Type specimen:—An adult female in alcohol, No. 79.11.21.148, British Museum, from Masuri, northern part of United Provinces, India. Collected by Captain Thomas Hutton.

Description:—Compared with the slightly more primitive *R. rouxi sinicus*, this species indicates an advance in specialization, though rather closely related. It may be recognized by the following characters: (1) in the wing there is a lengthening of the second phalanx of the third finger, so that it is conspicuously more than one and one-half times the length of the first; (2) the horseshoe is larger and the supplementary leaflet reduced to a mere small papilla on each side; the sella is distinctly pandurate (with the sides slightly concave), the connecting process, however, low and broadly rounded off; the lancet cuneate, that is, not concave at the sides or narrowed below the tip; (3) the skull differs in having the palate so shortened that its median length is only about a quarter that of the maxillary tooth row; (4) the small premolar (p^2) of the upper jaw is practically in the tooth row, while that of the lower jaw (p_3) is normally external to the row as in *rouxi*. This is a larger bat in bulk of body, with longer forearm (about 53 mm.) and slightly longer wings; the fur, too, is longer and more loose, not short and rather close as in *rouxi*.

Two color phases are recognized by Andersen, a darker in which the bases of the hairs above are grayish, their tips Mars or wood brown; the lower side paler, more drab or tawny olive. In the brighter phase, the color above is lightened by the bases of the hairs being buffy and their tips more tawny, the lower side almost pale ochraceous with browner flanks.

Measurements:—The forearm is 50 mm. or more to 56 mm. in length, hence larger than in the forms of *rouxi*. An adult male from Wanhsien measured in the flesh: head and body, 58 mm.; tail, 35; hind foot, 13; ear, 20; spread of wings, 318.

CRANIAL MEASUREMENTS OF *RHINOLOPHUS AFFINIS* AND SUBSPECIES

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
				R. affinis himalayanus						
56900	23.0	18.8	7.8	11.5	10.6	8.4	8.7	9.0	♂	Szechwan
56898	22.9	18.6	7.5	10.7	10.0	8.2	8.4	9.1	♂	Szechwan
56899	23.6	19.2	7.7	11.2	10.3	8.4	8.8	9.5	♂	Szechwan
56901	22.4	17.6	6.6	10.5	10.3	8.2	8.0	8.5	♂	Szechwan
57151	23.3	18.5	7.6	11.3	10.5	8.5	8.7	9.1	♂	Szechwan
57159	22.6	18.2	7.2	10.4	10.2	8.3	8.5	9.0	♂	Szechwan
				R. affinis macrurus						
44770	——	——	——	11.3	10.4	8.6	9.1	9.8	♂	Fukien
44698	23.7	19.4	8.3	11.1	10.6	8.8	8.8	9.5	♂	Fukien
44769	23.3	18.9	7.6	11.4	——	8.7	8.8	9.7	♂	Fukien
57182	23.2	19.4	7.5	11.9	11.4	9.3	9.2	10.3	♂	Fukien
57185	23.9	19.7	8.1	11.8	10.7	9.2	9.2	10.0	♂	Fukien
57187	22.7	18.8	6.6	11.4	10.7	8.5	8.7	9.2	♂	Fukien
				R. affinis hainanus						
58323	22.7	18.4	7.4	10.8	10.3	8.8	8.7	9.3	♀	Hainan
58350	22.0	17.8	7.0	10.7	10.4	8.3	8.4	9.1	♀	Hainan
58352	22.4	17.8	6.6	10.9	10.7	8.6	8.6	9.3	♀	Hainan
58361	22.5	18.0	8.0	10.8	10.5	8.1	8.7	9.4	♀	Hainan
58364	23.0	18.8	7.8	10.9	10.5	8.4	8.9	9.6	♀	Hainan
58365	22.6	18.0	7.3	11.0	10.5	8.5	9.0	9.5	♀	Hainan
58383	24.0	19.8	7.8	10.9	10.6	8.7	9.2	9.9	♀	Hainan
58396	23.8	19.2	7.6	11.5	10.6	8.6	9.0	9.9	♂	Hainan
58449	23.7	19.2	7.8	11.2	10.5	8.1	9.0	9.9	♂	Hainan
58470	24.0	19.6	8.0	11.1	10.5	8.3	9.0	9.8	♂	Hainan
Average	23.0	19.1	7.8	10.9	10.5	8.4	8.8	9.5		

Occurrence and Habits:—This bat has much the same general range as *R. rouxi* on the Asiatic mainland, perhaps penetrating farther into the hill country, as in India. Across southern China the two species occur in the same localities, so that they are likely to be confused unless the diagnostic characters as outlined are noticed. As a species it seems to be slightly more plastic, so that local forms are differentiated more readily. The present race, *R. a. himalayanus*, a slightly darker form than the following, is probably to be found in the more moist and elevated parts of western China and eastern India, while in the warm lowlands of eastern China, a slightly different form occurs which corres-

ponds fairly with Andersen's subspecies *R. a. macrurus*. Andersen mentions as representing *R. a. himalayanus* a specimen from Nanking, in Anhwei, but it is quite likely that additional material would show that this is not typical. I have referred to this subspecies a series from Wanhsien, Szechwan, and also two in alcohol from Shenchow, Hunan, which may, however, be again somewhat intermediate if enough comparative material were available. A further series was obtained by the American Museum Asiatic Expeditions from Likiang in Yunnan, and others from Tengyueh, one of which, on May 27, contained a large fetus.

Osgood (1932), in recording a series of skins and alcoholic specimens from Nguluko, near Likiang, Yunnan, refers them to the race *R. a. tener*, with some hesitation. Possibly the study of a larger and more representative series of the species from China would show that a further revision of names is necessary.

Specimens examined:—In all, twenty-eight, as follows:

Hunan: Shenchow, 2 (alcoholics).
Szechwan: Wanhsien, 10 (3 alcoholics).
Yunnan: Likiang, 8 (alcoholics); Tengyueh, 8 (alcoholics).

69. **Rhinolophus affinis macrurus** Andersen

Rhinolophus affinis macrurus Andersen, Proc. Zool. Soc. London, 1905, vol. 2, p. 103.

Type specimen:—An adult male in alcohol, No. 90.4.4.7, British Museum, from Taho, Karennee, southeastern Burma. Collected February, 1888, by Leonardo Fea.

Description:—Compared with *R. a. himalayanus* of western and central China, this race has a somewhat broader horseshoe, slightly longer tibia and ears; the tail also averages slightly longer.

The color is apparently quite the same as in *R. a. himalayanus*, with a darker, wood-brown phase having grayish bases to the hairs, and a brighter phase in which the bases of the hairs are bright buffy, their tips nearly tawny brown.

Measurements:—Andersen (1905e, p. 105) gives a table of comparative measurements, from which it appears that in his specimens of *R. a. himalayanus*, the length of ears is 17.2-18.5 mm., in *R. a. macrurus* from 20-20.7; the breadth of nose-leaves from 13.8-14.5, in *R. a. macrurus* 15.2-15.8; the tibia 22.8-23.8, against 23.9-25.4 in *R. a. macrurus*; the other dimensions, however, practically the same in both. A series of specimens from Fukien agrees with his description of *R. a. macrurus*, and I am referring them to that form, as A. B. Howell (1929) has done with a similar lot in the U. S. National Museum. The forearm

measurement in the specimens at hand is from 53.5-54, the length of tibia 25.

For cranial measurements see table, page 169.

Occurrence and Habits:—This slightly larger subspecies is evidently a more southern representative of *R. affinis*, and, since the type came from southeastern Burma, it is likely that the form ranges across Siam and Indo-China to the low country along the seaboard of southern China. The specimens at hand are all from near the coast, namely, from Tunglu, Chekiang Province, and Futsing, Yuki, and Yenping, Fukien Province, the last in the hills, a locality whence also the U. S. National Museum has specimens, referred by A. B. Howell to this form. Yuki is at an altitude of four thousand feet, and the specimens from here were taken in a cave. It will remain for future collecting to discover how far inland this race is found, but probably it is another of those mammals that just reach the southern border.

Specimens examined:—In all, fifteen, from the following localities:

Fukien: Futsing, 5; Yenping, 6; Yuki, 2.
Chekiang: Tunglu, 2.

70. **Rhinolophus affinis hainanus** J. A. Allen

Rhinolophus hainanus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 482, December 17, 1906.

Type specimen:—An adult female, skin and skull, No. 26748, American Museum of Natural History, from Pouten, island of Hainan, China.

Description:—This is a race of *R. affinis* differing from *R. a. himalayanus* in its broader horseshoe and in its richer russet color, in the latter respect closely resembling Fukien specimens of *R. a. macrurus*, but more cinnamon below, and a very little darker above. The forearm measurement is also a little smaller, in a series from Nodoa, averaging 50 mm., with very slight variation, and so 2-3 mm. smaller than in the mainland race. The length of the leg from knee to end of claws is also about 2 mm. less on the average.

Measurements:—In addition to the few differential measurements just given, the cranial measurements of a series of ten adults are given in the table, page 169.

Occurrence and Habits:—This richly colored race is presumably confined to the island of Hainan. In addition to the original series of twenty-seven from Pouten, Hainan, Mr. Clifford H. Pope collected thirty-eight at Nodoa in January, 1923.

Specimens examined:—In all, thirty-eight, from Nodoa, Hainan.

71. **Rhinolophus ferrum-equinum nippon** Temminck

Rhinolophus nippon Temminck, Monogr. de Mammalogie, vol. 2, 8th monogr., p. 30a, 1835.
Rhinolophus ferrum-equinum nippon Andersen, Proc. Zool. Soc. London, 1905, vol. 2, p. 110.
Rhinolophus ferrum-equinum Thomas, Proc. Zool. Soc. London, 1911, p. 687; *ibid.*, 1912, p. 128.

Type specimen:—The type of this race is presumably in the Leiden Museum, Holland, whither it was sent from Japan.

Description:—The bats of this species are in a more advanced stage of specialization than either of their allies, *R. rouxi* or *R. affinis*, especially as regards the reduction of the tooth row. They may be recognized by the following combination of characters: (1) the wing as in *R. affinis* is somewhat lengthened, so that the second phalanx of the third digit is more than one and one-half times the first; at the same time, the third metacarpal has become shortened, so that when the wing is folded, it is decidedly less than the fourth and fifth, while the last is very slightly longer than the fourth; (2) the horseshoe is broad and the sella is pandurate (with distinctly concave sides), the supplementary leaflet of the horseshoe smaller and less obvious than in *affinis*, the lancet not cuneate but with a long and rather slender tip (hastate); the connecting process low and broadly rounded off; (3) the skull has the palatal bridge long, nearly one-third the length of the maxillary tooth row, and its size is larger; (4) the small premolar of the upper jaw (p^2) is usually either quite outside the tooth row or is actually wanting, so that the canine and large premolar are in contact, their cingula overlapping, and the lower small premolar (p_3) is also external to the row; according to Andersen, the pandurate saddle combined with the external position of the small upper premolar suffices alone to distinguish this species among oriental bats, yet the upper small tooth may stand occasionally quite in the row; (5) the long tail, equaling one and one-third times the length of tibia, is further distinctive; (6) a reduction in the number of vertical grooves on the bare area of the lower lip is again a progressive character, for in this species the two lateral ones are lost, leaving only the median groove of the three usually present in *R. rouxi* and *R. affinis*.

In color these bats are a uniform smoky gray above very slightly tinted with buffy at the sides; the lower surface is practically the same. There is also a slightly brighter phase with pale brown tips to the hairs.

Measurements:—This race is slightly smaller than the more western ones, with smaller skull and teeth than *R. f. tragatus* of western China. In his table of measurements, Andersen gives as the forearm measurement 57.2-59.3 mm., therefore overlapping slightly those of *tragatus*, but the skull length is slightly less. In two specimens from Shantung, the forearms measure 56 and 60 mm. respectively, the tibia, 23, 23.3 respectively. The third meta-

carpal, 37, 40.4; its first phalanx, 19.5, 20; second phalanx, 34, 33; fourth metacarpal, 43, 45.5; fifth metacarpal, 45, 46.2.

For skull measurements see table.

CRANIAL MEASUREMENTS OF *RHINOLOPHUS FERRUM-EQUINUM* RACES

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Width across molars	Mastoid width	Upper cheek teeth	Lower cheek teeth	Locality
				R. ferrum-equinum nippon					
58281	24.8	20.0	7.8	12.3	9.1	10.0	10.7	11.0	Szechwan
84862	25.0	20.2	8.5	12.1	9.1	9.4	10.3	11.1	Fukien
84863	——	——	——	11.7	9.0	9.2	9.8	10.9	Fukien
84864	——	——	——	12.1	9.0	9.5	10.1	11.4	Fukien
84865	24.5	20.5	8.0	12.2	9.0	9.6	10.3	11.0	Fukien
84867	——	——	——	11.0	9.0	9.1	10.0	10.8	Fukien
25872 MCZ	23.5	19.0	8.4	11.5	8.5	8.5	9.2	10.8	Shantung
25873 MCZ	23.2	18.8	8.0	11.6	8.8	8.8	9.4	10.6	Shantung
				R. ferrum-equinum tragatus					
45047	24.5	20.0	8.1	12.0	8.9	9.0	9.4	10.9	Yunnan

Occurrence and Habits:—This eastern race of the wide-ranging horseshoe bat is typical in Japan, and according to Andersen, a specimen from Shanghai is indistinguishable, so that the bat from eastern China is regarded as the same. It ranges northward as far at least as southern Korea, and Ognev (1927, p. 142) has recorded his belief that it may occur at Vladivostok, although he complicates the matter by naming a large Japanese example *R. f. mikadoi* (from Yokohama). It is thus the most northerly species of the genus. Although not abundant, it evidently occurs throughout northern China, even in semi-desert areas. Thomas (1908f, p. 637) mentions a single specimen, a male, found hanging by itself in a cave thirty miles west of Peiping, and Jacobi (1922, p. 2) records fourteen others secured near that city by the Weigold Expedition. There are two skins in the Museum of Comparative Zoölogy, presented by Dr. Arthur Jacot, who secured them in a cave at Lungtung, southeast of Tsinan, Shantung. One of these is in the usual gray type of pelage, the other much paler, the bases of the hairs distinctly whitish or pale drab, tipped with slightly darker brown, but additional specimens are needed from northern China to determine whether a pallid race exists in the drier parts of this area. Its occurrence in Shensi has been mentioned by Thomas (1911e, p. 687), without reference to subspecies, in recording three females secured in the Shangchow district in the southeastern part of the province. A series of seven skins and skulls including two nearly full-grown young collected at Chunganhsien, Fukien, by Clifford H. Pope, and a skin and skull in the collection of the American Museum of Natural History taken by Dr. Walter Granger at Wanhsien on the border of eastern Szechwan, I provisionally

refer to this race, the last on account of its short forearm of 56 mm. It must be acknowledged, however, that the eastern race is not very different from the slightly larger *R. f. tragatus* in its general appearance. Andersen points out that this race has the upper small premolar less decidedly external to the tooth row than in the western races, so that it may not be surprising to find that, in the series from Chunganhsien, Fukien, it may even stand quite in the row separating the canine and the large premolar, as in *R. affinis*, but the great length of the palatal bridge at once throws it into *R. ferrum-equinum*. In some cases, as in the Shantung specimens, the two sides vary in the same skull.

Specimens examined:—In all, ten, as follows:

Shantung: Lungtung, southeast of Tsinan, 2.
Fukien: Chunganhsien, 7.
Szechwan: Wanhsien, 1.

72. **Rhinolophus ferrum-equinum tragatus** Hodgson

Rhinolophus tragatus Hodgson, Journ. Asiatic Soc. Bengal, vol. 4, p. 699, 1835.
Rhinolophus ferrum-equinum Dobson, Cat. Chiroptera British Mus., p. 119, 1878 (in part).
Rhinolophus ferrum-equinum tragatus Andersen, Proc. Zool. Soc. London, 1905, vol. 2, p. 111.

Type specimens:—The three cotypes, from Nepal, are now in the British Museum (Andersen, 1905e, p. 112).

Description:—This is a very slightly larger race than the more primitive *R. f. nippon*, with smaller teeth, and a skull that is smaller in general proportions, although the horseshoe and the nasal swellings upon which it rests are equally broad. The color is the same.

The skull represents "unquestionably a higher stage" of development than that of *R. f. nippon* (Andersen, 1905e, p. 112), for the small upper premolar is so forced out of the tooth row that it is wholly external, and the cingula of the canine and large premolar actually overlap, or in some cases it has disappeared altogether; in the lower jaw the small premolar (p_3) is likewise well on the road to disappearance, and if present is very minute and wholly external to the tooth row. It is absent in a large proportion of skulls.

Measurements:—Andersen gives the following measurements for this bat: ears, length, 21.8-24.5 mm.; breadth of horseshoe, 8.8-9.7; forearm, 59-63; third metacarpal, 37.2-40.3; its first phalanx, 20.5-23; second phalanx, 32-34.5; fourth metacarpal, 42-45.1; fifth metacarpal, 43.5-47.3; tail, 34.8-37; tibia, 25.6-26.6; foot, 13-14.3.

For cranial measurements see page 173.

Occurrence and Habits:—Probably this will be found to be the common form of the species in western China, chiefly in the highlands, for it seems to reach middle altitudes. The American Museum Asiatic Expeditions secured

it at Likiang and again at Tengyueh, in western Yunnan. A female from the latter locality, taken on May 22, 1917, contained a large fetus. Very likely the male recorded by Thomas (1912e, p. 128), without reference to the subspecies, as taken in a cave near Penhsien, thirty miles northwest of Chengtu, northern Szechwan, at 3,000 feet, is referable to this race.

Specimens examined:—In all, six, as follows:
Yunnan: Likiang, 2; Tengyueh, 4.

73. **Rhinolophus lepidus shortridgei** Andersen

Rhinolophus lepidus shortridgei Andersen, Ann. Mag. Nat. Hist., ser. 9, vol. 2, p. 377, October, 1918.

Type specimen:—A male, skin and skull, No. 18.8.3.1, British Museum, from Pagan, Irrawaddy River, Burma. Collected October 12, 1913, by Guy C. Shortridge.

Description:—A medium-sized species, distinguished by the following combination of characters: (1) the wing is not lengthened, so that the length of the second phalanx of digit III is less than one and one-half times the first; the metacarpals are practically equal, with the fourth very slightly the longest; (2) horseshoe not completely covering the upper lip, notched in the middle, with a small tooth-like projection on either side of it; a small supplementary leaf on each side; sella slightly concave at the sides, and somewhat narrower at top than bottom; connecting process projecting as an acute triangle beyond the summit; lancet hastate, lower lip with three vertical grooves; (3) the skull has a long palatal bridge, a trifle less than one-third the length of the maxillary row, and the zygomatic width is practically that of the mastoid portion of the skull; (4) the small upper premolar (p^2) is always in the tooth row, the small lower premolar (p_3) variable, in or somewhat external to the row; (5) the forearm measurement is about 42-43 mm. (see Andersen, 1905e, p. 122).

In color the bases of the hairs above are very light écru drab, tipped with wood brown or cinnamon; below, somewhat lighter.

Measurements:—The specimen mentioned below was measured in the flesh as follows: head and body, 51 mm.; tail, 20; hind foot, 9; ear, 20; spread of wings, 250; forearm (in skin), 43; metacarpals, subequal, length of third, 33.

Andersen (1918, p. 376) notes the following skull measurements based on a series of topotypes: total length to front of canine, 16.8-18.7; condylocanine length, 15-16.9; maxillary tooth row, 6.5-7.5.

Occurrence and Habits:—This is a slightly larger eastern race of *R. lepidus*, the typical form of the Indian peninsula, known hitherto from the type locality, Pagan on the Irrawaddy, and from Kindat on the upper Chindwin, Burma. A single skin, the skull for which is unfortunately lost, was secured by Dr. Walter Granger near Wanhsien, in extreme eastern Szechwan; the bat

was found wintering in a cave two miles northeast of the village of Yenchingkou, February 10, 1926. This is apparently the only record of the species from China, except that of Osgood (1932), who mentions a series of eleven from Nguluko, Yunnan (near Likiang), which, however, he regards as not altogether like any of the described subspecies. With a lens, the front face of the sella and the connecting process are seen to be covered with minute hairs.

Specimens examined:—One only (skin), from Wanhsien, Szechwan.

74. **Rhinolophus cornutus pumilus** Andersen

Rhinolophus cornutus pumilus Andersen, Proc. Zool. Soc. London, 1905, vol. 2, p. 127, fig. 22b.

Type specimen:—Adult female, in alcohol, No. 2.10.7.18, British Museum, from Okinawa Island, Riu Kiu group, Japan, March 16, 1902.

Description:—A small bat, forearm 39 mm., distinguished by the following characters: (1) wing not lengthened, the second phalanx of third digit not more than one and one-half times the length of the first; (2) nose-leaves much as in *R. lepidus*, with the sella slightly constricted in the middle, and its summit narrower than the base, the connecting process in side view acutely pointed, forming nearly an isosceles triangle; (3) skull smaller than in *R. lepidus*, and narrower; (4) arrangement of the teeth as in *R. lepidus*, the small upper premolar in the tooth row, the small lower premolar variable.

In color, the bases of the hairs of the upper side are contrastingly paler than their tips, whitish tinged with écru drab, while the tips are brown, giving a general effect of broccoli brown to Prout's brown. Under side "écru drab," darker on the flanks (Andersen).

Measurements:—Andersen gives the following: forearm, 38.8-39.7 mm.; third metacarpal, 27.7-28.7; its first phalanx, 10.7-11.4; second phalanx, 12.7-13.2; fourth metacarpal, 27.7-29.5; fifth metacarpal, 27.7-29.5; tail, 18; tibia, 16.2-17.2; foot, 8.

Skull: total length, 16; zygomatic width, 7.9; mastoid width, 7.8; upper cheek teeth, 5.7; lower cheek teeth, 6-6.1.

Occurrence and Habits:—This bat is recognizable by its small to medium size and the sharp-pointed connecting process, typical of the *R. lepidus* or *R. pusillus* group. Although described from the Riu Kiu Islands, Andersen regards a specimen collected by Swinhoe at Foochow as the same. It is also recorded from localities in the higher country of western China. Thomas (1911d, p. 160) records five from Kiatingfu, Szechwan, identified as this form by Andersen, as well as several secured in caves near Penhsien, thirty-five miles northwest of Chengtu, northern Szechwan, altitude 3,000 feet (Thomas, 1912e, p. 128). In southeastern China, Mell (1922, p. 13) mentions a specimen

from the northern part of Kwangtung, but says they are apparently more common in the southern part, living by day in colonies in caves or rock crevices, rarely in houses. In their haunts may be found, scattered beneath their resting places, the wings of various moths, as *Arcte*, *Grammodes*, *Ophideres*, *Ischyja*—owlets, or of geometrids.

Specimens examined:—None.

75. **Rhinolophus blythi szechwanus** Andersen

Rhinolophus blythi szechwanus Andersen, Ann. Mag. Nat. Hist., ser. 9, vol. 2, p. 377, 1918.
Rhinolophus minor G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 244, 1912.

Type specimen:—A female, skin and skull, No. 13.1.26.2, British Museum, from Chungking, Szechwan, China. Collected September 27, 1912, by W. R. Brown.

Description:—This species is the smallest of the genus occurring in China, with a forearm of about 37 mm. It may be further distinguished by the following points: (1) wing unlengthened, the second phalanx of the third digit not exceeding one and one-half times the first; (2) the sella broadest at the base, then slightly concave at the sides and narrower at the summit; the connecting process sharply pointed in side view, forming nearly an isosceles triangle; (3) the small upper premolar in the tooth row, and provided with a small cusp, the lower small premolar variable but frequently standing in the row or practically so.

The color above is a uniform brown, almost exactly "cinnamon brown" of Ridgway, the bases of the hairs everywhere conspicuously whitish; lower surface of body a pinker, paler tint of the same at the sides, the throat and mid-ventral region pale drab. Immature specimens are a grayer brown with less clear pale bases to the dorsal hairs.

Measurements:—The following measurements are from fresh examples made by the collectors in the field.

No.	Total length	Head and body	Tail	Hind foot	Ear	Spread	Locality
56909	—	38	23	8	15	205	Szechwan
56298	—	39	21	8	16	235	Szechwan
56918	—	42	22	8	17	227	Szechwan
58293	—	42	23	9	17	242	Szechwan
7515 MCZ	62	—	17	8	—	—	Szechwan
7516 MCZ	65	—	22	9	—	—	Szechwan
7517 MCZ	64	—	24	9	—	—	Szechwan
7518 MCZ	61	—	21	8	—	—	Szechwan

For cranial measurements see table, page 178.

CRANIAL MEASUREMENTS OF *RHINOLOPHUS BLYTHI* SUBSPECIES

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
				R. blythi szechwanus					
56909	15.8	12.5	5.3	7.2	7.5	5.6	5.6	5.6	Szechwan
56910	15.6	12.4	5.1	7.3	7.5	5.6	5.6	5.7	Szechwan
56911	16.5	13.1	5.2	7.3	7.8	5.5	5.6	5.9	Szechwan
56913	16.2	13.0	5.5	6.9	7.5	5.4	5.7	5.7	Szechwan
56919	16.4	——	5.6	7.5	7.5	5.5	5.5	5.7	Szechwan
56922	15.8	13.1	5.5	7.1	7.4	5.5	5.7	5.8	Szechwan
57160	15.8	12.6	4.7	7.2	7.4	5.6	5.3	5.5	Szechwan
58282	16.2	12.9	5.0	7.6	7.6	5.6	5.6	5.8	Szechwan
58287	16.4	12.9	5.0	7.1	7.5	5.2	5.5	5.5	Szechwan
58293	16.7	13.5	5.5	7.6	—	5.9	6.0	6.1	Szechwan
				R. blythi calidus					
44772	15.5	12.4	4.5	7.5	—	5.7	5.5	5.7	Fukien
84835	16.2	12.6	5.5	7.4	7.5	5.8	5.5	5.8	Fukien
83983	16.2	13.0	5.2	7.2	7.6	5.6	5.5	5.7	Fukien
83984	15.5	——	4.7	7.3	—	5.7	5.7	5.7	Fukien
44673	16.8	13.7	5.5	—	7.4	5.7	5.5	5.6	Fukien
				R. blythi parcus					
58312	16.0	——	5.0	7.5	—	5.7	5.8	6.0	Hainan
58329	15.8	12.8	5.0	7.3	7.5	5.7	5.6	6.0	Hainan
58451	16.3	13.0	5.3	7.4	—	5.8	5.6	5.8	Hainan
58358	15.8	12.2	4.7	7.5	7.5	5.6	5.8	6.1	Hainan
58461	16.7	13.4	5.4	7.9	7.9	5.7	5.9	6.2	Hainan
58465	16.5	13.3	5.4	7.5	7.7	5.7	5.7	6.0	Hainan
58469	16.0	12.9	5.1	7.5	—	5.7	5.7	6.1	Hainan
58474	16.1	13.0	5.0	7.1	7.3	5.7	5.4	6.0	Hainan

Occurrence and Habits:—This little bat is found probably across the more humid uplands of southern China. The type locality is Chungking, in Szechwan, and the Central Asiatic Expeditions secured a series from a cave near Wanhsien in the eastern part of the province in the winter of 1922-3. I have referred to it also four specimens from Ichang, Hupeh, in the Museum of Comparative Zoölogy. No doubt additional collecting will reveal its presence to the southwest of these localities in western Szechwan. It is the smallest of the Rhinolophi found in the region and darker in tint than the coastal race.

Specimens examined:—In all, forty-three, as follows:

Hupeh: Ichang, 4 (M.C.Z.).

Szechwan: Wanhsien, 39.

76. **Rhinolophus blythi calidus** G. M. Allen

Rhinolophus blythi calidus G. M. Allen, Amer. Mus. Novitates, no. 85, p. 1, August 28, 1923.

Type specimen:—An adult female, skin and skull, No. 44692, American

Museum of Natural History, from Yenping, Fukien, China. Collected June 17, 1916, by Dr. Roy C. Andrews.

Description:—In color this lowland race is much brighter than *R. b. szechwanus*, more cinnamon throughout. The bases of the hairs above are everywhere whitish, with a faint buffy tint, their tips dull cinnamon, near "sayal brown" of Ridgway; below, pale pinkish buff, the hairs becoming whitish near their bases.

The skull is a very little larger than in *szechwanus*, but otherwise there is little difference.

Measurements:—The size is practically the same as in the other subspecies: forearm, 38 mm.; tibia, 15; foot, 7.

For cranial measurements see table, page 178.

Occurrence and Habits:—This is merely a somewhat brighter-tinted lowland race of the Indian *R. blythi*, occurring probably in suitable places across southeastern China, as far north as Fukien Province. Although not a very strongly marked subspecies, the average difference, when series of the two forms are laid out in comparison, is considerable.

It is not unlikely that the specimen in the British Museum from Foochow, which Andersen (1905e, p. 127) doubtfully referred to *R. cornutus pumilus*, is really this. It was taken by Swinhoe many years ago, but its imperfect condition rendered its identification difficult.

Specimens examined:—In all, eighteen, as follows:

Fukien: Kuliang, 1; Futsinghsien, 2; Yenping, 14; Yuki, 1.

77. **Rhinolophus blythi parcus** G. M. Allen

Rhinolophus blythi parcus G. M. Allen, Amer. Mus. Novitates, no. 317, p. 2, May 19, 1928.

Type specimen:—Adult, skin and skull, No. 58465, American Museum of Natural History, from Nodoa, island of Hainan, China. Collected December 8, 1922, by Clifford H. Pope, Central Asiatic Expeditions.

Description:—Structurally like *R. b. szechwanus* of western China and *R. b. calidus* of southeastern China, but differing from both in its rich russet or darker brown coloring.

Color above in the red phase, nearly "russet" (Ridgway). The individual hairs over the back are pale ochraceous at their bases, deepening to a distinct russet tip about 2 mm. in length. Scattered among these are hairs with minute blackish tips, producing a darkening of the surface. On the sides of the head and on the neck, chest and mid-ventral area, the color is clearer, brighter russet; the throat is paler, pinkish buff. In the axillar region, ventrally, is a well-defined dusky area. Specimens in the brown phase are Mars brown,

paling to the roots of the hairs, above; below, drab washed with chestnut at the sides.

The cochleæ are very large, nearly meeting in the midline so that the basioccipital is very much narrowed. There is a well-defined sagittal crest, branching anteriorly to form a ridge over each orbit, with a slight depression between. The first small upper premolar stands quite in the tooth row, while in the lower jaw the minute middle premolar of the type specimen stands in the row, but in other specimens may be partly external to it.

Measurements:—In the type the forearm measures 36.3 mm.; third metacarpal, 27; fourth metacarpal, 28; fifth metacarpal, 27.6; tibia, 13.5; foot, 7.

The skull: greatest length, 16.5; basal length, 13.3; palatal length, 5.4; palatal bridge, 1.7; zygomatic width, 7.5; mastoid width, 7.7; width outside molars, 5.7; upper cheek teeth (canine to last molar), 5.7; lower cheek teeth (canine to last molar), 6.0.

See also table, page 178.

Among the specimens secured, a bright, tawny phase is the more common, while a deep-brownish phase is also represented. In its brighter, more intense coloring, it forms a marked contrast to the dull, gray-colored *R. b. szechwanus*, in which the bases of the dorsal hairs are whitish, their tips drab, the belly drab. In *R. b. calidus* of eastern China the color becomes slightly more buffy, but in this race from Hainan it is strikingly redder, even to the bases of the hairs. A series of over fifteen skins collected by Mr. Clifford H. Pope shows much uniformity of tint; but the dull-colored, grayish immature specimens are about as bright as adults of *R. b. calidus*.

In the dark or brownish phase this race resembles the two others mentioned, but is a much darker brown. The immature individuals of the series are similar, and it is possible that these brown adults are in reality not fully mature.

Occurrence and Habits:—Mr. Pope writes of these bats: "I caught several in the house at night and a few in a long tunnel out in the woods. The tunnel was an old irrigating ditch extending just beneath the floor of the low jungle. Another place where we got a few was an old prospector's hole about fourteen feet deep, with a slanting entrance and the mouth covered with grass and bushes. But the largest colony was at the inner end of a deep tunnel dug straight into the side of a grassy hill. The first trip revealed a colony of hundreds of bats but when the third visit was made they had deserted the place and only one or two stragglers were seen. This tunnel is double and is situated but a few miles west of Nodoa."

Specimens examined:—In all, eighteen, from Nodoa, Hainan.

78. **Rhinolophus pearsonii pearsonii** Horsfield

Rhinolophus pearsonii Horsfield, Cat. Mammalia Mus. East-India Co., p. 33, 1851.
Rhinolophus yunanensis Dobson, Journ. Asiatic Soc. Bengal, vol. 41, pt. 2, p. 336, 1872. Hotha, Yunnan.
Rhinolophus larvatus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 248, pl. 37A, fig. 1; pl. 37C, fig. 1, 1868-74 (not of Horsfield). Muping, China.

Type specimen:—The type was from Darjeeling, India, collected by John Thomas Pearson, and for many years was in the Museum of the Honourable East-India Company, London, whence it was later transferred to the British Museum.

Description:—This horseshoe bat seems to bear much resemblance to *R. ferrum-equinum* and *R. affinis* in size and general appearance, with a forearm of about 55 mm. and a wing structure like that of the former with the third metacarpal shortest, the fourth slightly longer, the fifth a trifle the longest; the sella is high and has its lateral borders peculiarly "crenulate," the connecting process low, rounded, and coming off well below the summit of the sella, while the lancet is regularly tapering or cuneate. In the skull the palate is unusually long, unshortened, nearly one-half the maxillary tooth row; there is a high sagittal crest, and the temporal fossa is so expanded that the width of the zygomata is greater than the mastoid width. The small upper premolar is minute but stands practically in the tooth row, and the small lower premolar is slightly external. There is only one median groove on the chin. The fur is long and loose, and described as uniformly dark brown.

The skull is well figured by Milne-Edwards, and shows the long palate, the minute upper premolar still in the tooth row, and the small lower one partly external.

Measurements:—The forearm measurement in both Milne-Edwards's *R. larvatus* and Anderson's *R. pearsonii* is 55 mm. The former adds the following: tail, 20; tibia, 26; foot, 12; no cranial measurements are available.

Occurrence and Habits:—The typical race extends its range from eastern India to the Chinese highlands, from southern Yunnan as far at least as central Szechwan, whence came the type of Milne-Edwards's *R. larvatus*, which, together with the type of *R. yunanensis* of Dobson, had already been made out as synonyms of *R. pearsonii* by Anderson (1879, p. 95), a decision since confirmed by Andersen (1905b, p. 289). Milne-Edwards's specimen was from Muping, while Dobson's type was collected by Anderson at Hotha, Yunnan. The only other record seems to be that of Thomas (1923, p. 656), who so identified a female taken at an altitude of 10,000 feet on the Likiang Range of western Yunnan.

Specimens examined:—None.

79. **Rhinolophus pearsonii chinensis** Andersen

Rhinolophus pearsoni chinensis Andersen, Ann. Mag. Nat. Hist., ser. 7, vol. 16, p. 289, 1905.
Rhinolophus pearsoni Thomas, Proc. Zool. Soc. London, 1898, p. 770. Shih, Bull. Dept. Biology, Sun Yatsen Univ., Canton, no. 4, p. 3, 1930.

Type specimen:—Adult male, skin and skull, No. 98.11.1.2, British Museum, from Kuatun, Fukien, China. Collected April 16, 1898, by J. D. La Touche.

Description:—"Similar to *Rh. pearsoni* from Darjeeling and Masuri, but with markedly shorter tibia, slightly smaller skull, narrower maxillar width, shorter mandible and tooth rows" (Andersen).

Measurements:—The forearm measurement of the type is 52.7 mm.; of the tibia 26 (29 in the typical form); the skull has a maxillary width of 9.2 (against 9.7-9.8); length of mandible 16.8 (against 17.7-17.9); maxillary tooth row, 9.5 (against 9.8-10.2); mandibular tooth row (exclusive of incisors), 10.3 (against 10.8-11.1).

The teeth are as in the typical form with the small upper premolar in the tooth row, but the small lower premolar slightly external to the row so that the two larger premolars are almost in contact.

Occurrence and Habits:—The type specimen from Kuatun, in northwestern Fukien, is the one earlier recorded by Thomas (1898, p. 770) as *R. pearsoni*, but on account of its slightly smaller size Andersen regards it as a separate race. The range probably covers the southeastern part of China, from Fukien southward. Mell (1922, p. 13) writes that he found it in the mountain forest to the south and north of the Canton region, as at Tsogokwahn, and in the mountainous country east of Siudsau. He suggests that these may have been the large bats seen in August at Wachowtoi, pursuing swarms of termites. The only other records of its occurrence that I have found are one by Shih (1930b, p. 1) from the southwest border of Hunan, and a second (Shih, 1930, p. 3) relating to two specimens from the Yao Shan area, Kwangtung, in both cases recorded as *R. pearsoni*.

Specimens examined:—None.

80. **Rhinolophus episcopus episcopus** G. M. Allen

Rhinolophus episcopus G. M. Allen, Amer. Mus. Novitates, no. 85, p. 2, August 28, 1923.

Type specimen:—An adult male, skin and skull, No. 56895, American Museum of Natural History, from Wanhsien, Szechwan, China. Collected October 9, 1921, by the Central Asiatic Expeditions, Dr. Walter Granger.

Description:—This is one of the smaller species of the genus, at once distinguished among Chinese bats by the following characters: (1) The wings

are not lengthened, so that the second phalanx of the third finger does not exceed one and one-half times the second, while in the fourth and fifth fingers the first and second phalanges are of about equal length. (2) The sella is remarkably broad (nearly 3 mm. in the dried skin), about half as broad as high, its extreme base slightly narrower, above which it at once reaches its full width and maintains it to the broadly rounded summit. At its base, the outer margins of the nostrils are continuous and raised to form a shallow cup, but do not form wing-like expansions. The connecting process begins well below the summit of the sella, is evenly convex and rather low, while the lancet is about as high as the sella, with convex sides and a rounded tip. The anterior horseshoe is broad, covering the muzzle, and has a deep median notch, and a small supplementary leaflet at each side in front. All the nose-leaves are covered with minute hairs except at the bottom of the cup between the nostrils. (3) The ears are moderately developed with a conspicuously broad antitragus. (4) The third metacarpal is the shortest, the fourth and fifth of equal length. (5) The skull has a low sagittal ridge, narrow zygomata, and a long palatal bridge equaling one-half the length of the maxillary tooth row. (6) In the upper jaw the small premolar (p^2) retains its primitive position fully in the tooth row, but in the lower jaw the small p_3 is external to the tooth row or at least partly so, or may be quite in the row.

The color above is smoke gray, the hairs dull whitish at their base. Below, the chin, throat, and middle of the abdomen are pale, almost white, shading into pale drab posteriorly, and pale cinnamon brown at the sides of the body.

Measurements:—The forearm of the type measures 47.5 mm.; third metacarpal, 34.5; fourth and fifth metacarpals, 36; tibia, 18 (all from the dried skin). The collector's measurements of specimens from Wanhsien are:

No.	Head and body	Tail	Hind foot	Ear	Spread of wings
56895	51	24	10	26	275
56896	50	32	10	26	280
84889	47	26	10	26	275
84888	51	25	9	26	268

CRANIAL MEASUREMENTS OF *RHINOLOPHUS EPISCOPUS EPISCOPUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
96895	——	——	——	8.2	9.2	6.2	7.0	7.2	Szechwan
84382	19.8	16.5	7.5	8.5	9.4	6.5	6.8	7.2	Szechwan
84385	19.8	16.0	7.2	9.0	9.6	6.4	6.9	7.2	Szechwan

Occurrence and Habits:—The remarkably large, parallel-sided sella rising from the slightly expanded cup-like margins of the internasal area distinguishes this bat at once, while the mitre-shaped lancet with convex sides rising to a

bluntly rounded tip is also distinctive. Like most other members of the genus, it is probably confined to the southern half of China, but at present it is known only from the type locality, Wanhsien, eastern Szechwan, where Dr. Walter Granger secured a few in October, 1921, and again from the same cave in December, 1925, and February, 1926, while they were in hibernation. It is apparently uncommon and perhaps not given to congregating in large numbers for the winter.

Specimens examined:—In all, thirteen, from Yenchingkou, Wanhsien, Szechwan.

81. **Rhinolophus episcopus caldwelli** G. M. Allen

Rhinolophus episcopus caldwelli G. M. Allen, Amer. Mus. Novitates, no. 85, p. 3, August 28, 1923.

Type specimen:—An adult female, skin and skull, No. 44771, American Museum of Natural History, from Yuki, Fukien, China. Collected October 31, 1916, by Rev. Harry R. Caldwell.

Description:—Similar to the typical form but smaller, with a forearm of 43 against 48 mm., the pelage above a warmer, cinnamon tint near "sayal brown," instead of smoky, a difference about similar to that separating the upland and lowland races of the small *R. blythi.*

In the skull the teeth are noticeably smaller; the small upper premolar is fully in the tooth row and has a long sharp cusp.

Measurements:—The type and only known specimen measured: forearm, 43 mm.; tibia, 17; foot, 9; third metacarpal, 31.5; fourth and fifth metacarpals, 33. Skull: occiput to front of canine, 18 mm.; occipital condyle to front of canine, 15.5; palatal bridge, 3; zygomatic width, 7.8; mastoid width, 8.5; width outside molars, 6.7; width across canines, 3.7; maxillary tooth row, 6.0; mandibular tooth row, exclusive of incisors, 6.5.

Occurrence and Habits:—The single specimen on which this form is based was taken in a cave at the summit of a mountain, by Rev. H. R. Caldwell, whose helpful cooperation has resulted in the acquisition of many interesting specimens from Fukien. It is evidently a slightly smaller and more brightly colored form of the species discovered on the borders of the Szechwan highlands, and in these characters it is paralleled by various bats. It is evidently uncommon and probably not a social species to any extent.

Specimens examined:—One only, the type, from Yuki, Fukien.

82. **Rhinolophus lanosus lanosus** Andersen

Rhinolophus lanosus Andersen, Ann. Mag. Nat. Hist., ser. 7, vol. 16, p. 248, 1905.
Rhinolophus luctus Thomas, Proc. Zool. Soc. London, 1898, p. 770. Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 14, 1922.

Type specimen:—An adult female, skin and skull, No. 98.11.1.1, British

Museum, from Kuatun, northwestern Fukien, China. Collected April 4 (=18), 1898, by J. D. La Touche.

Description:—This is a species of the *R. philippinensis* group (Andersen), characterized by the expansion of the base of the sella to form a cup-like structure with, in the more advanced species, wing-like outgrowths. The pelage is peculiar in being dark smoky in color and woolly. It may be distinguished by the following details: (1) Anterior horseshoe broad, covering the muzzle, but without a supplementary leaflet at the side; outer borders of the nostrils raised to form a conspicuous projecting rim, the inner borders likewise raised, forming a deep cup; base of the sella on each side widely expanded laterally, forming with the erect and rather narrow sella a trefoil; connecting process very low and rounded, beginning well below the summit of the sella; terminal lancet long, narrow, and tongue-shaped, terminating in a rounded point. (2) Wings not especially modified, the second phalanx of digit three less than one and one-half times the first; third metacarpal considerably shorter than the fourth, which is slightly shorter than the fifth. (3) The skull is notable for the high sagittal crest, the relatively small temporal fossa, narrow maxillary width, and the deeply hollowed post-nasal depression, corresponding to the large nose-leaves. The teeth are proportionally small; the small upper premolar is quite in the tooth row, but its cusp inconspicuous, while in the lower jaw the small premolar also stands well in the row, separating the two larger premolars. (4) The nature of the pelage is peculiar among Chinese bats in its texture; it is long, slightly crinkly or woolly, and is uniformly sooty throughout. The ears and membranes are blackish.

Measurements:—The forearm of the type measured 71.5 mm., that of a specimen from Yenping, 69. The latter also gives the following: third metacarpal, 45 mm.; its first phalanx, 25; second phalanx, 35; fourth metacarpal, 52; fifth metacarpal, 54.5; tibia, 34; foot, 16.

For skull measurements see table, under *R. l. spurcus*, page 186.

Occurrence and Habits:—This bat is at once distinguished among Chinese species by its large size, blackish woolly fur, and the great development of the nasal leaves, with the base of the sella expanded to form a trefoil. It is perhaps only the continental representative of the Javan *R. luctus*, to which the type specimen from Kuatun, Fukien, was originally referred by Thomas (1898, p. 770), although his date does not correspond with that given in Andersen's description. The specimen was said by Thomas to have been taken on "18/4/1898," which evidently through inadvertence became April 4th, 1898, in Andersen's paper. As there was but one specimen, however, there can be no doubt that the two references relate to the same individual. This is apparently not a common species in southeastern China. Rev. H. R.

Caldwell secured one in a chambered charcoal pit in the mountains near Yenping, 2,000 feet, and others in the same locality, seven in all. Apparently it is not colonial in its habits. Two from Foochow, Fukien, are also in the collection of the American Museum. Mell (1922, p. 14) mentions a dark, woolly bat taken in the mountains east of Siudsau, Kwangtung, that was doubtless this, though referred to *R. luctus*.

Specimens examined:—In all, nine, as follows:
Fukien: Yenping, 7; Foochow, 2.

83. **Rhinolophus lanosus spurcus** G. M. Allen

Rhinolophus lanosus spurcus G. M. Allen, Amer. Mus. Novitates, no. 317, p. 3, May 19, 1928.

Type specimen:—An adult male, skin and skull, No. 58444, American Museum of Natural History, from Nodoa, island of Hainan, China. December 4, 1922. Clifford H. Pope, collector, Central Asiatic Expeditions.

Description:—A large, dark, woolly-haired bat, like typical *R. lanosus* of Fukien in external proportions, but the skull much larger and the fur more sooty brown, about dull chocolate brown above and below, tipped minutely with gray, so as to give a slightly frosted effect.

Although the bodily dimensions are practically the same as in the mainland animal, the skull is decidedly larger. The supraorbital ridges in both meet to form a prominent sagittal crest and cut off anteriorly a triangular depression between the orbits. The parietal area shows a curious pitting of the surface of the bone. The small upper premolar is quite in the tooth row, but the lower one is partly external, clearly separating the two large premolars, whereas in the Fukien race it is smaller and more external, allowing these two teeth to meet.

Measurements:—In the type and a second male, the forearm measures respectively 70, 71 mm.; the third metacarpal in the type, 44.7; fourth metacarpal, 53.2; fifth metacarpal, 54.2; tibia, 36; foot, 18.

CRANIAL MEASUREMENTS OF THE RACES OF *RHINOLOPHUS LANOSUS*

No.	Greatest length to front of canine	Basal length	Palatal length	Zygomatic width	Palatal bridge	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
				R. lanosus lanosus						
44763	28.3	——	——	14.0	4.9	13.0	10.5	10.5	12.0	Fukien
				R. lanosus spurcus						
58444	31.3	——	——	15.5	—	13.5	10.4	11.3	12.0	Hainan
58446	30.0	26.2	11.0	14.7	5.0	13.5	10.2	11.4	12.3	Hainan

Occurrence and Habits:—This island race, though externally as large as the mainland form, has a strikingly larger skull than the Fukien examples. It is apparently uncommon and of solitary habits, two specimens being all

that were secured by Mr. Clifford H. Pope during his stay in Hainan. One of these was found in a prospector's shaft in the midst of woods; and a second individual was started from a similar shaft but was not secured. The other specimen was taken in a tunnel in a wooded locality. In each case, the solitary bat, hanging from among roots in the ceiling, was the only inhabitant of the cave.

Specimens examined:—Two only, from Nodoa, Hainan.

84. **Rhinolophus rex** G. M. Allen

Rhinolophus rex G. M. Allen, Amer. Mus. Novitates, no. 85, p. 3, August 28, 1923.

Type specimen:—An adult female, skin and skull, No. 56890, American Museum of Natural History, from Wanhsien, Szechwan, China. Collected October 12, 1921, by Dr. Walter Granger.

Description:—A large bat with remarkably developed nose-leaves, belonging apparently to the *R. philippinensis* group (in original description said to be of the *R. macrotis* group). It may be distinguished among Chinese species by the following characters: (1) wings ample, but not specially lengthened, the second phalanx of the third digit not exceeding one and one-half times the first; metacarpals about equal; (2) nose-leaves greatly developed, the anterior horseshoe very broad, extending 3 or 4 mm. beyond the muzzle, deeply notched in the median line, and without supplementary leaflet at the sides; inner edges of the nostrils produced upward all around to form a deep cup, with a narrow median slit in the front, and extending backward beyond the base of the sella wing-like; the sella broad, obovate and minutely hairy, rising from the posterior side of the nasal cup, its lateral border convex, its summit broadly rounded; the connecting process is reduced, beginning considerably below the summit of the sella, low and narrow; the lancet extremely low, about one-third the height of the sella, with broad convex outline; (3) wings from the tarsus, calcaneum slender, about one and one-half times the length of the foot; (4) ears very large with a relatively enormous antitragus of about half their height; (5) fur rather long, about 16 mm. on the back, 10 mm. on the chest, in color a light "cinnamon buff" above, paler below except at the extreme sides of the axillæ; a thin fringe of hair borders the inner edge of the ear conch and the rib parallel to it on the lower three-fifths of the ear.

The skull is peculiar in having the surface of the brain case above the ear cancellar or spongy in appearance with numerous small fenestræ as far forward as the orbit. The prominent nasal swellings are elliptical with a deep cavity behind, but there is no narrow rim of bone at their anterior margin as in some of the bats of this group, despite the size of the nose-leaves. The sagittal crest is well marked but low. The small premolar of the upper jaw is fully in the tooth row, and may even have a narrow space separating it

from the last premolar, yet its cusp is small; in the lower jaw the minute middle premolar is also fully in the row. The palatal bridge is remarkably long, extending posteriorly nearly to the plane of the hind edge of the last molar.

Measurements:—The collector's measurements of fresh specimens give the following figures:

No.	Head and body	Tail	Hind foot	Ear	Spread	Locality
56890 (type)	55	38	10	33	356	Szechwan
56891	60	38	13	34	362	Szechwan
84891	65	32	12	35	360	Szechwan

The forearm measures 58 mm. in the type; third metacarpal, 41.5; its first phalanx, 17; second phalanx, 26; fourth metacarpal, 43; fifth metacarpal, 43; tibia, 21.

CRANIAL MEASUREMENTS OF *RHINOLOPHUS REX*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
56890 (type)	——	——	——	10.0	11.0	7.0	8.0	8.0	Szechwan
56891	24.0	20.4	9.8	10.5	11.3	7.3	8.5	8.0	Szechwan
84381	23.0	19.2	9.4	10.0	11.0	7.0	8.1	8.4	Szechwan

Occurrence and Habits:—It seems extraordinary that so peculiar and so large a bat should not have been discovered previous to the work of the Central Asiatic Expeditions, but possibly its distribution or habits are in some way restricted or peculiar. The deep cup formed by the edges of the nostrils, the broad tongue-shaped sella, low connecting process, and reduced rounded lancet are unusual characters, while the position of the small premolar teeth in the tooth row and the great length of the palatal bridge are primitive traits, as well as the nearly equal metacarpal lengths. All the specimens seen are from the cave at Yenchingkou, near Wanhsien, eastern Szechwan, where Dr. Walter Granger stayed for three winters. On frequent occasions he sent his collectors to the cave during the winter to collect bats hibernating there and succeeded in securing in all seven of this species. In the development of its nose-leaves it represents almost the climax stage of which *R. episcopus* is at a much more primitive level. The only other record for this species seems to be that of Sanborn (1933) of a female taken at Tungwongtien, Kweichow, to the south. He mentions that the nose-leaves are lower and narrower than the measurements originally given.

Specimens examined:—In all, seven, including one in alcohol, from Wanhsien, eastern Szechwan.

Family HIPPOSIDERIDÆ

HORSESHOE BATS

This family is closely related to the Rhinolophidæ, but was for the first time distinguished by Miller in 1907, on the ground of its further specializa-

tions of the girdles and feet, while the form of the nose-leaf is also different, and the lower small premolar of *Rhinolophus* is lost. In the feet the toes have but two phalanges each. The first and second ribs are fused to their vertebræ and to the presternum, making a solid bony ring, and the lumbars are fused to form a solid bony rod. The nose-leaves consist of an anterior horseshoe, with sometimes smaller accessory leaflets; the sella and connecting process of the Rhinolophidæ are not present, but an erect transverse leaf corresponds to the lancet, and is usually divided by vertical septa into three cell-like portions, the apices of which may be produced into points. The first finger of the wing, digit II, consists of the metacarpal only, while the other fingers have but two phalanges each.

The family is confined to the warmer parts of the Old World, from the Mediterranean region and Africa east to southern China, and beyond to the Philippines and Australia. Three genera occur in China: *Hipposideros* with well-developed tail, the molars with normal styles, toes without traces of the original phalanges; *Cælops* with a rudimentary tail, the molars with unusually well-developed styles, and the last upper molar with a distinct but short fourth commissure (Miller, 1907, p. 114); and *Triænops*, with the zygomatic plate remarkably wide vertically and the terminal nose-leaf tripartite. The chief points may be keyed as follows:

KEY TO THE GENERA OF CHINESE HIPPOSIDERIDÆ

A. Tail well developed.
   a. Zygomata not expanded vertically to form a wide plate; nose-leaf not deeply trilobate ..... *Hipposideros*
   b. Zygomata expanded to form a deep vertical plate; nose-leaf cleft into three narrow lobes ..... *Triænops*

B. Tail minute; horseshoe covering the muzzle very deeply cleft in the middle.. *Cælops*

Genus **Hipposideros** Gray

Hipposideros Gray, Zoological Miscellany, no. 1, p. 37, 1831.
Phyllorhina Bonaparte, Iconogr. d. Fauna Ital., vol. 1, pt. 21, 1837.

Reference may be made to Miller (1907, p. 110) for synonymy and diagnosis of the genus. In addition to the characters of the nose-leaves previously mentioned, *Hipposideros* may be recognized by the large triangular ears without tragus, but instead a large antero-external lobe as in *Rhinolophus*, the well-developed tail, the toes without trace of the original phalanges. The skull has the nasal portion full and rounded; there is a low sagittal crest, and the posterior part of the zygoma is usually more or less abruptly expanded. The upper canines may have a secondary cusp near their base; the first upper small premolar is usually crowded out from the tooth row, while in the lower jaw the corresponding small premolar that was present in *Rhinolophus*, is

permanently lost. The tooth formula, therefore, has one less tooth than in the latter, namely: i.$\frac{1}{2}$ c.$\frac{1}{1}$ p.$\frac{2}{2}$ m.$\frac{3}{3}$ = 30.

The type species is *Hipposideros speoris* of India.

Four species are known to occur in China, distinguishable by the following key:

KEY TO THE CHINESE SPECIES OF *Hipposideros*

A. Size larger, forearm 80 mm., or more.
   a. Nose-leaf with four supplementary leaflets, skull with profile of muzzle evenly sloping ..... *H. armiger*
   b. Nose-leaf with only two supplementary leaflets, skull with profile of muzzle flattened ..... *H. pratti*

B. Size smaller, forearm much less than 80 mm.
   a. Forearm about 60 mm., nose-leaf with three supplementary leaflets *H. poutensis*
   b. Forearm about 42 mm., nose-leaf without supplementary leaflets.. *H. gentilis sinensis*

85. **Hipposideros armiger armiger** (Hodgson)

Rhinolophus armiger Hodgson, Journ. Asiatic Soc. Bengal, vol. 4, p. 699, 1835.

Type specimens:—According to Andersen, the types, a male and a female in alcohol, from Nepal, are now in the British Museum.

Description:—A very large bat, forearm about 85 mm.; tibia, 40; third and fourth metacarpals practically equal, the fifth very slightly shorter; wings from the ends of the tibiæ, calcaneum only about one-half the length of the tibia. Ears large, triangular, but the antero-external lobe not prominent. Nose-leaves consist of a large horseshoe partly covering the muzzle, with four narrow accessory leaflets at each side of it, the fourth and most external merely a wart-like excrescence. The main horseshoe is not deeply notched in the middle, and the skin at the outer border of the nostril is slightly raised; immediately behind the nostrils is a thickened transverse ridge with a strong vertical rib in the middle, behind this a thinner transverse ridge divided by vertical ribs into three sections, while on each side behind these ridges is a thickened fleshy but rather compressed half-ridge. A frontal gland opens between and in front of these last.

In color, the bases of the hairs above are grayish white or pale drab, their tips wood brown to Vandyke brown, the lower surface of the body wood brown, scarcely paler at the bases of the hairs.

The skull is notable for its high sagittal crest continued forward to the interorbital region, whence the profile slopes evenly forward and downward to the bases of the canines, making an angle of nearly 45 degrees with the line of the tooth row. In front view this region forms a somewhat pentagonal shield with a minute central foramen for the passage of a nerve to the nose-leaves. The posterior half of the zygoma is expanded vertically to a little more than double the height of the anterior part. In the upper jaw, the minute

first premolar is crowded outward into the angle between the canine and the large premolar, which, however, are not quite in contact in some specimens, although practically so in others; in the lower jaw the minute premolar is, of course, missing, while the two large premolars may even overlap slightly.

Measurements:—In the following list are both inland and coastal forms, the latter represented by *swinhoii*.

EXTERNAL MEASUREMENTS OF *HIPPOSIDEROS ARMIGER*

No.	Head and body	Tail	Hind foot	Ear	Forearm	Third metacarpal	Fifth metacarpal	Tibia	Locality
				H. armiger armiger					
44524	90	57	17.0	34	85.0	62.0	59.0	37.0	Yunnan
44536	85	63	19.0	32	95.0	64.0	58.5	36.0	Yunnan
44530	100	61	18.0	32	91.0	66.0	61.6	38.0	Yunnan
				H. armiger swinhoii					
57168	—	—	17.5	—	95.0	66.0	62.0	38.0	Fukien
57169	—	—	17.0	—	91.5	64.0	62.0	37.0	Fukien
24235 MCZ	104	70	21.0	29	98.0	65.0	66.0	40.0	Chekiang
24236 MCZ	110	60	20.5	34	97.0	66.5	64.0	42.0	Chekiang
24243 MCZ	103	53	17.5	35	82.5	58.3	56.0	35.0	Chekiang

There is no constant difference in size between males and females.

The cranial measurements of these forms are:

No.	Length, occiput to front of canine	Basion to canine	Palation to canine	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
				H. armiger armiger					
44524	31.2	26.0	11.5	18.0	15.0	13.0	12.0	14.0	Yunnan
44530	31.3	26.0	11.6	17.5	15.0	12.8	12.5	13.8	Yunnan
44534	32.7	27.0	12.0	18.5	15.5	13.0	13.0	14.0	Yunnan
44536	32.2	27.0	12.8	18.5	15.5	13.0	13.0	14.5	Yunnan
				H. armiger swinhoii					
57168	33.0	27.5	12.5	19.2	16.0	13.1	13.0	14.0	Fukien
57169	32.2	26.2	12.7	18.3	15.6	13.3	13.0	14.1	Fukien
60206	31.7	26.5	12.0	17.5	15.4	12.3	12.5	13.6	Fukien
60212	31.6	26.0	12.0	17.8	15.3	12.8	12.0	13.5	Fukien
24234 MCZ	31.2	26.0	11.5	18.0	15.5	12.3	12.3	13.6	Chekiang
24236 MCZ	32.5	27.0	11.7	18.3	15.8	13.0	12.3	13.4	Chekiang
24243 MCZ	31.9	26.0	11.8	18.0	15.1	13.0	12.5	13.5	Chekiang

Occurrence and Habits:—The range in general is from Masuri and Nepal in northeastern India, eastward across southern China, as a species, to Chekiang, and southward, merging into the slightly smaller race *H. a. debilis* in the Malay Peninsula. The American Museum Asiatic Expeditions secured a fine series, partly in alcohol, from various localities in southwestern Yunnan,

as at Tengyueh, Taipingpu, Homushu Pass, as well as many more from Wanhsien, eastern Szechwan. Andersen (1906) mentions a specimen in the British Museum from Kiatingfu in east-central Szechwan, while Howell (1929, p. 14) records a specimen in the U. S. National Museum from the latter station, as well as one each from Suifu and Hwangtsaopa, in the same province, and a third from Changshowkai, Hunan. Thomas (1912e, p. 128) has recorded two males from caves near Penhsien, thirty-five miles northwest of Chengtu, central Szechwan, which may represent nearly the limit of its range to the northward in China, while Sanborn (1933) mentions specimens in the Field Museum from this province and from Kweichow. These localities indicate a range across the southern half of China, from the Yangtze basin southward. It is a cave-dwelling species and highly colonial.

Specimens examined:—In all, eighty, from the following localities:
Yunnan: Homushu Pass, 1; Taipingpu, Shweli River, 27; Tengyueh, 23; Yunnanfu, 1.
Szechwan: Wanhsien, 20, and 28 skulls.

86. **Hipposideros armiger swinhoii** (Peters)

Phyllorhina swinhoii Peters, in Swinhoe, Proc. Zool. Soc. London, 1870, p. 616.
Hipposideros armiger swinhoii G. M. Allen, Amer. Mus. Novitates, no. 85, p. 4, 1923.
Hipposideros armiger of authors, in part.

Type specimens:—Andersen states that the three cotypes of this bat, collected as skins by Robert Swinhoe, at Amoy, Fukien, China, 1867, are in the collection of the British Museum.

Description:—Quite similar to the typical form, but the coloring slightly brighter, the brown of the back a cinnamon brown rather than wood brown, the lower surfaces buffy brown instead of drab.

In measurements and other characters this bat is not distinguishable from the typical race.

Measurements:—See tables under *H. armiger armiger.*

Occurrence and Habits:—When Andersen reviewed the bats of this group, he (1906) regarded *H. swinhoii* as a synonym of *H. armiger*, and pointed out that Peters in bestowing the name, was considering only the distinction between it and *H. diadema.* Andersen himself had chiefly alcoholic material to work with, in which, naturally, colors are hardly appreciable. With a fine series of skins before me, from Szechwan and Fukien, it was apparent that those from the warm coastal area are of a much brighter tint than the duller specimens from the interior. I, therefore, in 1923, revived Peters's name for the former. It is not impossible, of course, that the brighter color of the coastal animal is merely a matter of age or alternative phase, and that the distinction cannot be maintained. The series collected by the American Museum Asiatic Expeditions, however, seems to indicate that the variation is geographic.

This bat was first recorded from China by Swinhoe (1870c), who secured a large number in a cave at Amoy, in summer. What may be one of these very specimens has been in the mounted collection of the Museum of Comparative Zoölogy for many years, obtained through Ward's Natural Science Establishment, in 1881. The American Museum Asiatic Expeditions secured a series at Yenping and Hsiyuenkeng in the same province, and a single specimen at Chinkiang, Kiangsu, near the mouth of the Yangtze, which, with others from Tunglu, Chekiang, just east of there, is the most northerly record I have found for the species, although Andersen mentions a skin in the British Museum from "North China." A. B. Howell (1929), in recording other specimens from Yenping in the U. S. National Museum, mentions the brighter ground color of the lowland animal, and adds that the latter is appreciably smaller, but this latter character does not seem to be true of the series I examined, and possibly his specimens were not fully mature. One of the specimens from Yenping (No. 60212, A.M.N.H.) is very bright in tint, and perhaps represents a rufous phase, having the under parts, head, nape, and sides ferruginous to orange-rufous, the hairs of the back slightly tipped with darker. An April specimen, probably a young of the previous year, has the bases of the hairs soiled white, tipped with smoky brown, the lower side drab, much as in adults of the duller, inland form. Cabrera (1922, p. 163) mentions specimens from Foochow, and others sent by Swinhoe to the Madrid Museum in 1867. Shih (1930) notes it from Yao Shan, Kwangtung, and from southwestern Hunan (1930b, p. 1). Probably the bat mentioned by Mell (1922, p. 13) as *H. diadema* is either this or *H. pratti* (neither of which he includes) from the Canton region, where *H. diadema* is not yet certainly known.

Specimens examined:—In all, thirty-seven, as follows:
Kiangsu: Chinkiang, 1.
Fukien: Hsiyuenkeng, 3; Yenping, 27; Amoy, 1 (M.C.Z.).
Chekiang: Tunglu, 5.

87. **Hipposideros pratti** Thomas

Hipposiderus (sic) *pratti* Thomas, Ann. Mag. Nat. Hist., ser. 6, vol. 7, p. 527, 1891.
Hipposideros pratti A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 13, 1929.

Type specimen:—A female in alcohol (No. not given), in the collection of the British Museum, from Kiatingfu, Szechwan, China. Collected by A. E. Pratt.

Description:—Although of the same general size and appearance as *H. armiger*, the two species are not at all closely related, as appears on a closer inspection. Although the forearm is about the same length in both, the tibia of *pratti* is longer (about 34 mm. against 26); there are only two instead of four supplementary nose-leaves outside the horseshoe; also, the skull is

very different in the rostral portion, for, whereas in *H. armiger* the profile of the muzzle slopes evenly from the top of the sagittal crest to the base of the canines, forming an angle of about 45 degrees with the plane of the palate, in *H. pratti* this region is so flattened that there is an almost perpendicular drop from the summit of the sagittal crest, and the rostral region is so depressed as to have a profile nearly parallel to the plane of the palate.

Fur above in adults cinnamon or tawny, or tinged with buff on its basal two-thirds or on the nape and throat for most of its length; on the back the tips of the hairs are dark brown with pale points giving a dusty effect. Below, the bases of the hairs are dark brown, their tips cinnamon. Immature specimens are much darker, with the tips of the hairs drab brown, their bases dull whitish, lacking the cinnamon tint.

The horseshoe does not completely cover the muzzle and has two (instead of four as in *H. armiger*) supplementary nose-leaves at each side. The outer margins of the nostrils are slightly extended as a projecting rim. Adult males have the posterior erect portion of the leaf very much more developed than in females and young males, so that instead of a low ridge it is a pair of prominent, nearly naked leaves, deeply divided at the median line, and in a dried skin nearly 9 mm. high. In females and young males it is low and inconspicuous, more or less concealed by surrounding hairs. In both sexes a long pencil of black hairs marks a median gland at its base behind. These striking differences in the nose-leaves of the two sexes have been illustrated by Osgood (1932, p. 223).

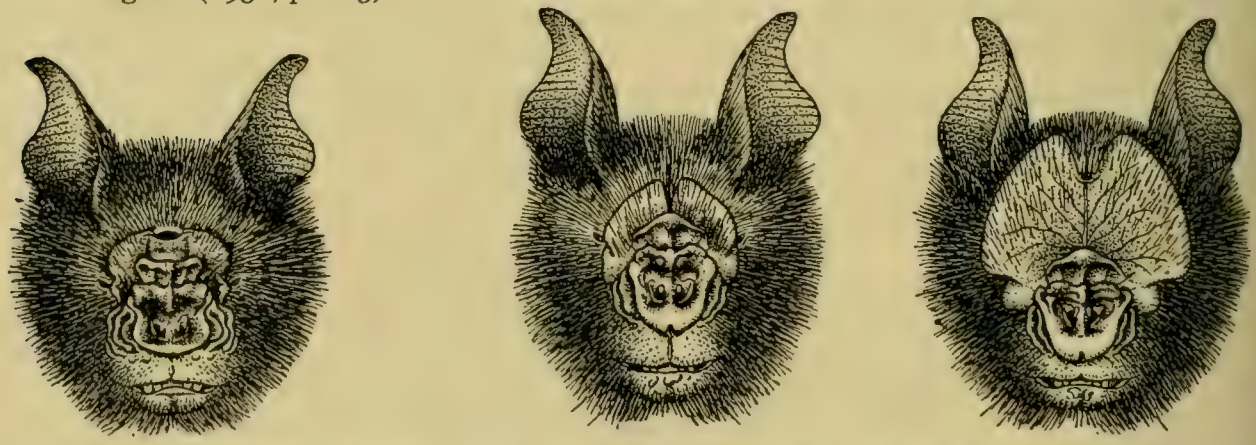

FIG. 12. Nose-leaves of *Hipposideros armiger*, male (left), and *Hipposideros pratti*, male (right) and female (center), natural size. After Dr. Wilfred H. Osgood (courtesy of Field Museum of Natural History).

Measurements:—The type measured: head and body, 90 mm.; tail, 56; ear from crown, 24; tibia, 35; foot with claws, 21; forearm, 83. In two skins, the forearm measures 88.5 and 90 mm. respectively; the tibia, 35.5, 34; hind foot with claws, 18, 20.

The following measurements were taken in the flesh by the collector, J. T. Wright, of bats secured at Tunglu, Chekiang; those of forearm and tibia are from the dried skins.

No.	Total length	Tail	Hind foot	Ear	Forearm	Tibia
24240 MCZ	161	61	22.0	33.0	89.0	34.0
24241 MCZ	163	56	21.0	35.0	89.5	32.5
24242 MCZ	161	59	21.0	32.0	86.0	34.0
24247 MCZ	151	50	21.0	30.0	87.5	33.0
24248 MCZ	166	59	20.5	33.5	87.3	33.0

CRANIAL MEASUREMENTS OF *HIPPOSIDEROS PRATTI*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
60198	33.0	27.0	12.3	18.4	16.0	12.0	12.8	14.2	♂	Fukien
60201	34.0	28.0	12.4	18.0	15.7	11.7	12.7	14.0	♂	Fukien
60202	33.3	27.8	12.8	17.5	16.0	11.9	12.6	13.9	♂	Fukien
60205	33.5	27.8	12.2	18.7	16.2	12.1	12.6	13.9	♂	Fukien
60207	33.0	27.3	12.1	17.6	16.0	11.9	12.5	14.0	♂	Fukien
60208	34.6	28.5	13.0	18.5	16.2	12.6	13.0	14.7	♂	Fukien
Average	33.5	27.7	12.4	18.1	16.0	12.0	12.7	14.1		
60197	32.9	27.0	12.0	17.3	16.0	11.3	12.1	13.5	♀	Fukien
60199	32.4	26.8	11.7	17.0	15.0	11.5	12.2	13.5	♀	Fukien
60200	33.0	27.4	12.5	18.0	16.0	11.7	12.0	13.6	♀	Fukien
60203	32.4	26.4	11.9	18.2	16.0	12.1	12.0	13.4	♀	Fukien
60209	33.0	27.4	12.4	17.5	15.8	12.0	12.0	13.7	♀	Fukien
60210	32.6	27.0	11.8	17.6	15.7	11.8	12.4	13.8	♀	Fukien
Average	32.7	27.0	12.0	17.6	15.7	11.7	12.1	13.6		

Occurrence and Habits:—Notwithstanding their superficial similarity, *Hipposideros pratti* and *H. armiger* are not closely related, as already shown, but differ remarkably in the shape of the skull, in the character of the nose-leaves, and in the length of the tibia. The two are frequently found hanging up in the same cave, but no doubt in separate clusters, although no information is at hand on this point. At the type locality, Kiatingfu, Szechwan, this species was found in the same cave with *H. armiger*, and this was true also at Yenping, Fukien, where Caldwell and Andrews secured a series; Howell has recorded both species from the latter locality, as well as a skull from Futsing. Jacobi (1922, p. 2) mentions three males from Wanhsien, eastern Szechwan, and notes that the males have a larger posterior nose-leaf than females. Howell has also recorded it from Changshowkai, Hunan. No doubt it will eventually be found over most of southeastern China, but apparently it does not extend into India. The most northerly record available is from Tunglu, Chekiang, where at the mouth of the Yangtze, J. T. Wright secured a series of this species and of *H. armiger*.

Specimens examined:—In all, thirty-nine, as follows:

Fukien: Futsing, 1 (skull); Yenping, 33.
Chekiang: Tunglu, 5.

88. **Hipposideros poutensis** J. A. Allen

Hipposideros poutensis J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 483, 1906.

Type specimen:—An adult male, skin and skull, No. 26698, American Museum of Natural History, from Pouten, island of Hainan, China. Collected July 2, 1904.

Description:—"Ears large, nearly as broad as high, thick and leathery, with 7 or 8 transverse ribs, the lower ones longest and heaviest; inner border nearly straight, becoming convex near the tip, which is short and rather obtuse; outer border slightly hollowed below the tip; upper transverse portion of the nose-leaf narrow, slightly convex, the free portion about 8 mm. transversely and 2.5 mm. high, or about as wide (transverse measurement) as the horseshoe, the anterior face with three vertical ridges, most distinct basally; horseshoe with a slight notch on its free border, and with three small leaflets on either side; no frontal sac behind the nose-leaf, or at least none distinguishable in even softened skins; wings from the distal fifth of the tibia; tail very pointed, most of the last vertebra exserted; thumb short, with the nail about 7 mm.; feet short, about 9 mm. without the claws.

"Color above (type), at the surface russet brown, basal two-thirds of the fur pale buffy gray; below similar but much paler, the hairs slightly gray-tipped; ears brown, membranes blackish brown."

Measurements:—"Type (from softened, well-filled skin), head and body, 62; tail, 28; forearm, 60; thumb, 7; third metacarpal, 43; fourth, 43; fifth, 41; third finger (with metacarpal), 82; fourth finger, 65; fifth, 65; tibia, 23; calcaneum, 10; foot, 9 mm. The forearm averages 60.6 in a series of 27 adult specimens, ranging from 58 to 63, with 6 at 60, 15 above 60, and 6 below 60.

"Skull (of type), greatest length, 24; zygomatic breadth, 13; width at nasal protuberance, 8; mastoid breadth, 11; width at outer base of canines, 6.5; upper lateral tooth row (including canine), 9; length of lower jaw, 16."

CRANIAL MEASUREMENTS OF *HIPPOSIDEROS POUTENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
26696	——	——	8.6	12.9	11.3	9.2	8.9	9.8	Hainan
26697	23.9	——	8.8	13.2	11.6	9.0	8.8	9.8	Hainan
26702	22.5	——	8.9	——	——	9.4	9.1	9.9	Hainan
26716	——	——	——	12.7	11.4	9.1	8.6	9.5	Hainan
26718	——	——	8.6	(13.0)	——	9.2	8.9	9.7	Hainan
26725	——	——	8.5	12.5	——	8.8	8.5	8.8	Hainan
26729	23.8	——	9.1	(13.0)	——	9.0	9.0	9.8	Hainan

"*Young:*—Ears smaller, thinner, less prominently ribbed; nasal appendages as in the adult but less developed. Color above seal brown to slaty brown, without or with very slight reddish brown suffusion, the basal portion of the fur whitish gray in the darker specimens, faintly buffy gray in the seal brown specimens; below dark grayish brown to dull drab, the hairs slightly light-tipped."

Occurrence and Habits:—The above is the original description, to which I can add little. It is based on a series of fifty specimens secured at Pouten, Hainan, July 2 and 4, 1904, including adult and immature individuals. No other specimens have been taken since. The relationship of this to other described forms is not yet wholly clear. Dr. J. A. Allen notes that it "is doubtless closely related to *Hipposideros leptophyllus* (Dobson), from the Khasia Hills, eastern Bengal, but differs from it in being considerably smaller, and in many details of structure, as in the smaller ears, relatively much shorter tail, broader transverse portion of the nose-leaf, etc." Perhaps, too, it is related to *H. turpis* of the Japanese archipelago which is of about the same size, and has a nose-leaf apparently similar.

Specimens examined:—Ten of the type series, from Pouten, Hainan.

89. **Hipposideros gentilis sinensis** Andersen

Hipposideros gentilis sinensis Andersen, Ann. Mag. Nat. Hist., ser. 9, vol. 2, p. 380, 1918.
Phyllorhina aurita Swinhoe, Proc. Zool. Soc. London, 1870, p. 616.
Phyllorhina fulva Dobson, in J. Anderson, Anat. and Zool. Researches Western Yunnan, p. 98, 1879.
Hipposideros fulvus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 484, 1906 (not of Gray).
?Hipposideros stoliczkana Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 9, p. 2, 1930.

Type specimen:—A skin and skull, No. 92.2.1.3, British Museum, from Foochow, Fukien, China. Collected by J. D. La Touche.

Description:—This is the smallest Chinese member of the genus hitherto known, with forearm about 44 mm., and occurs in a brown and a yellow phase. The horseshoe is simple, lacking supplementary leaflets, unnotched in the middle, and with the other parts of the nose-leaves minutely hairy; under a lens the external border of the nostrils is seen to be slightly raised, and a median ridge runs from between the nostrils to the anterior border. The posterior erect portion is low and divided into three cells. The ears are large, thin and naked, except at base, with a low, well-haired antitragus. In the wing the third metacarpal is slightly the shortest, the fourth and fifth about equal; the basal phalanx of the third finger slightly exceeds the second in length; the hind legs are proportionally long.

In the brown phase, the fur of the upper surface is cottony white for the basal two-thirds to three-fourths, tipped with dull brown; below, the throat and abdomen are dull grayish white, with across the chest a band of drab.

In the brighter phase, the fur of the dorsal side is golden yellow at base, inconspicuously brown-tipped, the lower side uniformly pale yellow.

In the skull the small upper premolar is very minute, barely as high as the weak cingulum of the canine, and lies in the angle between the latter and the large upper premolar, external to the line of the tooth row, although there may be a minute space between these two teeth.

Measurements:—This race differs from typical *H. gentilis* of Masuri, Burma and Pegu by its slightly larger size, grading into the latter on the west and into *H. g. atrox* in the Malay Peninsula. In *H. g. sinensis* the forearm measurement is from 40-43 mm., against 38.5-41.5 in typical *H. gentilis*, not a very striking difference. In a male from western Yunnan, this dimension is 43.5 mm., in one from Fukien, 42. The tibia in the same two is, 17, 18; third metacarpal, 31, 31; fourth metacarpal, 33, 31.5. Head and body, 45; tail, 32; foot, 9.5; ear, 24.5 (flesh measurements of the former specimen).

The cranial measurements are as follows:

CRANIAL MEASUREMENTS OF *HIPPOSIDEROS GENTILIS SINENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
84813	17.9	14.0	6.2	8.6	9.0	6.0	6.0	6.6	Fukien
84814	17.5	14.0	6.3	8.8	9.1	6.1	6.2	6.6	Fukien
84816	17.7	14.2	6.1	8.2	8.7	5.8	6.0	6.5	Fukien
84817	18.0	14.2	6.0	8.8	9.4	6.2	6.3	6.5	Fukien
84818	17.8	14.2	6.3	8.9	9.0	5.6	6.0	6.5	Fukien
84819	17.8	14.0	6.4	8.8	9.0	5.7	6.0	6.5	Fukien
84821	18.0	14.5	6.5	8.9	9.3	6.0	6.2	6.5	Fukien
84823	18.0	14.4	6.5	8.8	9.1	6.0	6.2	6.5	Fukien
84824	17.8	14.0	6.4	8.6	9.6	5.7	6.0	6.6	Fukien
84831	17.4	14.1	6.1	8.6	9.0	5.9	6.0	6.5	Fukien
Average	17.7	14.1	6.2	8.7	9.2	5.9	6.1	6.5	
58321	17.0	13.5	5.7	8.7	9.0	5.6	5.7	6.0	Hainan
58382	17.9	14.2	6.0	8.7	9.0	5.8	6.0	6.4	Hainan

Occurrence and Habits:—This is another species characteristic of southern China, probably not extending so far north as the large species of the genus. At all events, on the eastern coast there seems to be no evidence of it farther north than Fukien, while to the westward it is present in southern Yunnan, but apparently not in Szechwan. Its small size, cottony-white bases to the hairs in the brown phase, golden in the yellow, will serve to distinguish it at once from among Chinese species. Whether the golden ones represent old adults or not is uncertain, but doubtless the immature and young-adult specimens are drab-brown. A series of nineteen, all in the brown phase, was secured by Mr. Clifford H. Pope, from "the coffin cavity of an old stone grave" in the low, rolling grassy hills of the Fukien coast a few miles south of Futsing.

Seven of these (November 27, 1925) were females, the rest males, hence at this season, at any rate, the sexes were not segregated. Five others taken at Nodoa and Namfong, on the island of Hainan, are not distinguishable from those of Fukien mainland; only two were in the yellow phase. A number from Yenping, Fukien, collected by Dr. R. C. Andrews, are in the yellow phase. Five others from Yungchang in Yunnan, would be expected to approach the typical form, but do not seem to differ appreciably from the eastern specimens. This is the bat called *Phyllorhina fulva* by Dobson, in reporting on the bats collected in eastern Burma and western Yunnan by Anderson (1879), while J. A. Allen records as *Hipposideros fulvus*, specimens from Rinsui, Hainan, noting that the brown phase is Gray's *H. murinus*. Doubtless, too, Swinhoe's *Phyllorhina aurita*, which he found common at Amoy in May, is the same. Possibly the bat recorded without comment by Shih (1930b, p. 2) as *Hipposideros stoliczkana*, from the southwestern border of Hunan, is also this, for he does not mention this common species, and the latter (an *Asellia*) is not positively known from China.

Specimens examined:—In all, fifty, as follows:

Fukien: Futsing, 19; Yenping, 21.
Hainan: Namfong, 1; Nodoa, 4.
Yunnan: Yungchang, 5.

Genus **Triænops** Dobson

Triænops Dobson, Journ. Asiatic Soc. Bengal, vol. 40, pt. 2, p. 455, 1871.

Externally the bats of this genus resemble *Hipposideros* in having a well-developed tail, but the terminal portion of the nose-leaf is divided into three narrow, pointed lobes instead of ending in a semicircular fold. The dental formula and general structure of the teeth are likewise as in *Hipposideros*, but the upper incisors are bifid. The zygomata are much expanded, so that in some species there is a high vertical plate forming the greater part of the posterior portion. One species only is known from China. The genotype is *T. persicus* of Persia.

90. **Triænops wheeleri** Osgood

Triænops wheeleri Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, p. 224, 1932. Sanborn, Proc. Biol. Soc. Washington, vol. 46, p. 56, 1933.

Type specimen:—An adult female, skin and skull, No. 32236, Field Museum of Natural History, from Muong Moun, Tongking, French Indo-China. Collected March 21, 1929, by Dr. Ralph E. Wheeler.

Description:—A small bat, forearm about 42 mm., externally like *Hipposideros*, except that the terminal margin of the nose-leaf is divided into three distinct pointed lobes close together at the apex. Tail slightly projecting from the edge of the interfemoral membrane. The anterior horseshoe is

supplemented by two lateral marginal leaves. Ears about reaching to the nostrils when laid forward.

The color is described as brownish (bister) above, or sooty, perhaps representing two color phases, the hairs broadly white at the base. The under surfaces of the body are pale "snuff brown," slightly paler at the bases of the hairs.

Measurements:—Osgood gives the following averages for the measurements of six adults from the type locality: total length, 84 mm.; tail, 39; hind foot, 8; forearm, 41.6 (dry). An adult in alcohol measured: forearm, 42; second finger, metacarpal, 32; third finger, metacarpal, 31.5; fifth finger, metacarpal, 28; tibia, 18; hind foot, 9; calcar, 10.

The skull of the type measured: greatest length, 15 mm.; condyle to front of canine, 13; zygomatic width, 7.4; mastoid width, 7.1; width across nasal swellings, 4.4; height of zygomatic plate, 2.0; upper cheek teeth, 5.2.

Occurrence and Habits:—This recently described species was discovered in two places in western Tongking, Indo-China, by the Kelley-Roosevelts Expedition in 1929. Its presence in southern China was, therefore, to be expected, and has lately been substantiated by the finding of three specimens at Tungwongtien, forty miles southwest of Wenshui, Kweichow. These are now in the Field Museum of Natural History, and Sanborn (1933) in commenting on them, writes: "The specimens are preserved in alcohol and were so badly shot that but one skull is complete enough for study. The skull and wing measurements are both slightly larger than those of the type series. . . . More material may show these Chinese specimens to represent a slightly larger subspecies. . . . This is the first record of the genus for China."

Specimens examined:—I have examined two of the original series from Indo-China.

Genus **Cœlops** Blyth

Cœlops Blyth, Journ. Asiatic Soc. Bengal, vol. 17, pt. 1, p. 251, 1848.
Chilophylla Miller, Proc. U. S. Nat. Mus., vol. 38, p. 395, 1910.

This genus is readily distinguished from its ally *Hipposideros:* (1) By the large funnel-like ears, in which the antitragus, instead of being marked off by a deep notch, is high and more or less continuous with the upper edge. (2) By the peculiar shape of the nose-leaves, which consist of the usual horseshoe over the muzzle, but modified so that it appears to be two distinct broad leaves separated by a deep cleft in the middle, while beneath each is a single supplementary leaflet in the shape of a strap-like narrow lappet projecting forward on each side beyond the upper horseshoe-like portion. The usual transverse upright portion is present behind the nostrils, and behind that is the transverse posterior leaf, having a small heart-shaped projection in the middle. All these outgrowths are minutely hairy. (3) By the very rudi-

mentary tail, less than 2 mm. in length. (4) By the teeth in which there is a marked secondary cusp on the upper canine, while the upper molars are "peculiar in the narrowness of the inner portion, the unusual development of the styles, and the great depth of the reentrant angles" (Miller, 1907, p. 114). The tooth formula is the same as in *Hipposideros*, viz.: i.$\frac{1}{2}$ c.$\frac{1}{1}$ pm.$\frac{2}{2}$ m.$\frac{3}{3}$ = 30.

Two species occur in China, a brown, *C. inflata*, and a gray, *C. sinicus*. They seem to be rare, for very few specimens have been taken.

91. **Cœlops inflata** Miller

Cœlops inflata Miller, Proc. Biol. Soc. Washington, vol. 41, p. 85, March 16, 1928. A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 15, pl. 2, fig. f, 1929.

Type specimen:—An adult male, in alcohol, No. 238991, U. S. National Museum, from near Yenpingfu, Fukien, China, 2,000 feet altitude. Collected April 7, 1922, by Arthur de C. Sowerby.

Description:—"Externally there appears to be nothing to distinguish the animal from *Cœlops robinsoni*," which in turn is merely a smaller form of *C. frithii*, having fur grayish at the base, tipped with warm brown. In the alcoholic type, the color is doubtless not readily made out. The main differences, as compared with *C. robinsoni* from Pahang, are in the larger brain case, the more extreme narrowing of the interorbital region, and less sharp definition of the supranarial swellings on the rostrum. In dorsal view the brain case is at once seen to project more laterally beyond the level of the zygomata. The teeth "are slightly larger than those of *Cœlops robinsoni*, a feature more noticeable in the lower mandibular series," in which the first and second molars have the inner border broader in proportion to the outer, and the hypocones better developed; the cingulum is more conspicuous on the outer borders of the lower molars; and the posterior lower premolar is larger and its length is greater in proportion to its height (Miller, 1928).

Measurements:—The following measurements are given for the type and only known specimen: head and body, 34 mm.; tibia, 15.0; foot, 8.0; forearm, 35.6; thumb, 8.8; third metacarpal, 27; fourth metacarpal, 28; fifth metacarpal, 29; ear from meatus, 14.

The skull measures: greatest length, 15.1 mm.; condylobasal length, 13.0; zygomatic breadth, 6.6; rostral breadth, 3.6; interorbital constriction, 1.6; length of brain case, 9.2; breadth of brain case, 7.6; depth of brain case, including auditory bulla, 6.4; mandible, 8.8; maxillary tooth row, 5.0; mandibular tooth row, 5.6.

Occurrence and Habits:—Beyond the single type specimen taken by Mr. Sowerby near Yenping, in Fukien, there are no other Chinese specimens known. Eventually it may prove that this is merely a subspecies of *C. robinsoni*. In his paper on Chinese mammals in the U. S. National Museum,

A. B. Howell has figured the skull of this and *C. robinsoni*, to show the very differently shaped brain case (Howell, 1929, pl. 2, fig. f).

Specimens examined:—One, the type, from Yenping, Fukien.

92. **Cœlops sinicus** G. M. Allen

Cœlops sinicus G. M. Allen, Amer. Mus. Novitates, no. 317, p. 4, May 19, 1928.

Type specimen:—An adult female, skin, No. 84893, and skull, No. 84388, American Museum of Natural History, from a cave two miles northeast of Wanhsien, Szechwan, China. Collected February 26, 1926, by Dr. Walter Granger, Central Asiatic Expeditions.

Description:—Pelage long, dense, and woolly, about 11 mm. in length in the middle of the back, blackish for the basal two-thirds, the terminal third indistinctly brown, nearly sepia of Ridgway (1912); lower surfaces similarly blackish at base of the hairs, then minutely ringed with brownish and tipped with gray, giving an indistinctly tricolor effect. Membranes and large translucent ears smoke gray.

The nose-leaves are similar to those of *C. frithii*, the horseshoe and median erect process posterior to the nostrils thickly clothed with short stiff hairs, while longer hairs, arising from the sides of the nose-leaves behind the horseshoe, form a well-defined fringe. On each side are six longer hairs, one from back of the anterior edge of the horseshoe, three along its lateral edge, and two erect, from the face of the raised ridge behind the nostrils.

The wing in this genus is peculiar for the shortness of the third finger and the length of the fifth; the thumb has a very long metacarpal and short phalanx (7: 1.6 mm.), the former wholly involved in the membrane; the second digit has no phalanges and is minutely longer than the combined metacarpal and first phalanx of the third digit. The latter is the longest digit, due to the great length of its second phalanx, for its metacarpal and first phalanx are shorter than those of the fourth and fifth digits. The wing arises from the metatarsus at the base of the toes. The calcaneum is well developed, as long as the toes.

The skull is remarkably delicate, with a nearly globular brain case, and very narrow interorbital portion, to which the sharp sagittal crest is confined. The frontal shield is nearly flat, its dorsal surface inclined at a sharp angle to the plane of the tooth row, and its anterior swellings but little raised above the general level on each side. The peculiar prolongation of the premaxillæ and maxillæ gives the skull a profile that tapers nearly to a point in front.

The upper canine is noticeably compressed, with a prominent secondary cusp, about half-way on the posterior edge. The small upper premolar is distinctly crowded to the outer side of the tooth row, but there is a minute space between the large premolar and the base of the canine. In the lower

jaw the outer incisor abuts closely against the canine, instead of being separated by a space as in *C. frithii*, and in height barely exceeds the cingulum of the canine. The anterior small lower premolar is slightly external to the line of the tooth row. All the lower cheek teeth are much compressed, almost blade-like.

Measurements:—The collector's measurements are: head and body, about 38 mm.; ear, 16; spread of wings, 232. The forearm measures 35.5; thumb, metacarpal, 7; its phalanx, 1.6; second finger, metacarpal, 35; third finger, metacarpal, 26.3; its first phalanx, 7; second phalanx (somewhat bent), 22; fourth finger, metacarpal, 28.6; its first phalanx, 9.0; second phalanx, 10.2; fifth finger, metacarpal, 30.5; its first phalanx, 10.1; second phalanx, 12.0; tibia, 16.4; foot, 8.0; calcar, 5.

Skull: greatest length, 17.0 mm.; basal length, 13.5; condyle to front of canine, 15.1; palatal length, 6.2; median length of premaxillaries, 4.0; zygomatic width, 7.8; mastoid width, 8.2; interorbital constriction, 1.8; width of frontal shield, 3.9; width outside molars, 5.8; front of canine to back of last upper molar, 6.4; lower tooth row, incisor to back of last molar, 6.8.

Occurrence and Habits:—By a curious coincidence, the description of this species was written and sent in for publication before that of *C. inflata* reached me, but was not published until two months after the latter. Any doubts as to the specific difference of the two were dispelled, however, when, in company with Dr. Wilfred H. Osgood, I had an opportunity to compare both types, as well as specimens of *C. frithii*. The present is a very different species, lacking the shining brown-tipped hairs above, for the brownish rings are so small in comparison that they hardly lessen the gray appearance of the fur, while *C. frithii* is a very brown-looking bat. The type and only known specimen of *C. sinicus* was taken in midwinter in a "warm-air" cave at Wanhsien, where it was evidently hibernating. This cave had very few bats in it and was much warmer than other neighboring caves. Bats of this genus seem to be rare, for few specimens get into collections. No doubt, too, it is largely solitary in habits.

Specimens examined:—One only, the type, from Wanhsien, Szechwan.

Family VESPERTILIONIDÆ
VESPERTILIONINE BATS

This is a widely distributed family of bats in both Old and New Worlds, and the only family that is commonly represented in temperate regions. Externally its members are usually distinguishable by the moderately developed ears, separate (rarely joined across the head), with tragus, and lacking nose-leaves or other outgrowths of the muzzle, tail not reduced, but extending to the margin of the interfemoral membrane. In the wing the second finger has

a metacarpal and one small bony phalanx, the third finger three phalanges, of which the terminal one is mostly cartilaginous. The skeleton of the wing is peculiar in the large secondary articulation of the outer supplementary head (trochiter) with the scapula, the great reduction of the ulna to a mere thread distally, while at the base it is fused with the radius. The seventh cervical vertebra is not fused with the first dorsal, nor are the lumbars fused, while the sacral vertebræ still have their outlines traceable. The skull lacks postorbital processes, and has present the ascending branches of the premaxillaries only. There is always a distinct emargination or notch between them anteriorly. The teeth are of the usual insectivorous type without modification of the cusps for fruit-eating (see Miller, 1907). These bats thus combine rather unmodified external structure with specialized wing development.

The family is well represented in China by at least twelve or thirteen genera, possibly more, depending on how closely one divides the group. The genera here recognized may be known by the following key, representing four subfamilies as defined by Miller (1907).

KEY TO THE GENERA OF CHINESE AND MONGOLIAN VESPERTILIONIDÆ

A. Nostrils normal, not produced as short tubes; anterior upper premolars (p^2, p^3), if present, conspicuously smaller than the last (p^4).

a. Ears not funnel-shaped.

a′. Second phalanx of third finger less than three times the length of the first; median lobe of presternum not larger than the body of that bone..... Subfamily Vespertilioninæ

a″. Six teeth behind the canine, above and below.

1. Hind foot, plus claws, shorter than tibia..... *Myotis*
2. Hind foot, plus claws, equaling tibia..... *Rickettia*

b″. Less than six teeth behind the canine, above.

1. Ears much longer than head, three lower premolars on each side..... *Plecotus*
2. Ears not especially elongated, two lower premolars on each side.

a. Outer upper incisor not extending beyond cingulum of inner, its crown flat; size large.. *Ia*

b. Outer upper incisor extending distinctly beyond the cingulum of inner, pointed; size small or medium.

a′. Fifth finger short; when wing is folded it scarcely exceeds metacarpals 3 and 4.... *Nyctalus*

b′. Fifth finger longer than combined metacarpal and first phalanx in digits 3 and 4.

a″. Ears not joined across forehead..... *Pipistrellus*

b″. Ears distinctly joined by a low brow band..... *Barbastella*

b′. Second phalanx of third finger long, about three times the length of the first phalanx..... Subfamily Miniopterinæ
One genus; tooth formula: i.$\frac{2}{3}$ c.$\frac{1}{1}$ p.$\frac{2}{3}$ m.$\frac{3}{3}$=36..... *Miniopterus*

b. Ears funnel-shaped, their outer margin wide, and commencing slightly in front of the inner margin; sternum very short and broad, its median length less than twice the width of its anterior expansion..... Subfamily Kerivoulinæ
One genus; tooth formula: i.$\frac{2}{3}$ c.$\frac{1}{1}$ p.$\frac{3}{3}$ m.$\frac{3}{3}$=38..... *Kerivoula*

B. Nostrils produced as a short tube; first and second upper premolars of about the same size..... Subfamily Murininæ
Tooth formula: i.$\frac{2}{2}$ c.$\frac{1}{1}$ p.$\frac{2}{2}$ m.$\frac{3}{3}$=34..... *Murina*

Genus **Myotis** Kaup

Myotis Kaup, Skizzirte Entw.-Gesch. u. Naturl. Syst. d. Europ. Thierw., vol. 1, p. 106, 1829. Type species, *Vespertilio myotis* Borkhausen = *Myotis myotis* (Borkh.).

Bats of this genus are very widely distributed, for they occur in every continent of the globe, including Australia, and in the northern hemisphere extend as far as the limit of tree growth in the summer season. Indeed, there is no other group of land mammals that is quite so universal in occurrence. The species of the genus are many, differing in details of structure that are often not apparent on casual inspection; yet it is possible to recognize several groups of more closely interrelated forms, to which names have been applied in a generic or a subgeneric sense. Nevertheless, on account of the many intermediate stages or combinations of characters shown by various species, it seems better for the present to retain them all within the single genus. Thus the Old World species with very large feet have been called *Leuconoë* by Thomas, and Bianchi has given the additional generic names *Capaccinius* and *Rickettia* to include certain European and Asiatic species, in addition to some half-dozen subgeneric names.

The Chinese species of this genus vary in size from the big *M. chinensis* with a forearm of 65 mm., to the small, weak-footed *M. moupinensis* of less than half the proportions of *M. chinensis*. In color all are dark brown or dark gray, except the large *M. formosus rufo-niger* which is a handsome rufous.

In its tooth characters this genus probably represents the most generalized condition in the subfamily Vespertilioninæ. The formula contains the maximum number to be found in living bats, namely: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{3}{3}$=38. Of the premolars, the anterior two are small, while the third (representing pm^4 and pm_4) is the largest. The molars have the W-pattern of cusps well developed on the first and second of the upper jaw, with a distinct protocone and hypocone. In many species there is a small protoconule between the former and the paracone. The third upper molar is reduced through the loss of the posteriormost style (metastyle) and its commissure and the diminished size of the hypocone.

The skull itself is usually rather slender with smoothly rounded brain case and slightly upturned rostrum.

The type species is the large *Myotis myotis* of Europe.

KEY TO THE CHINESE AND MONGOLIAN SPECIES OF *Myotis*

A. Size large, forearm 45 mm. or more.
  a. Forearm about 45 mm., skull with short, slightly upturned muzzle..... *Myotis altarium*
  b. Forearm more than 45 mm.
    a'. Forearm about 50 mm.
      a''. General color orange and black..... *M. formosus rufo-niger*
      b''. General color dark brown above, gray below..... *M. pequinius*
    b'. Forearm 60 mm. or more.
      a''. Forearm 60 mm.; belly whitish..... *M. myotis ancilla*
      b''. Forearm about 65, belly dark grayish..... *M. chinensis* and *M. c. luctuosus*

B. Size small, forearm less than 40 mm.
  a. Smaller, forearm 31-33 mm.
    Second upper small premolar in the tooth row..... *M. muricola moupinensis*
    Second upper small premolar internal to the tooth row.. *M. davidii*
  b. Larger, forearm 35-39 mm.
    a'. Forearm about 39 mm.
      a''. Tibia long, 20 mm., foot less than half its length... *M. frater*
      b''. Tibia shorter, about 15 mm., foot more than half its length..... *M. fimbriatus*
    b'. Smaller, forearm less than 39 mm.
      a''. Foot large, obviously more than half the tibia..... *M. daubentonii*
      b''. Foot smaller, about half the length of tibia.
        1. Upper molars without obvious protoconule, hair-tips above glossy..... *M. mystacinus*
        2. Upper molars with distinct protoconule, fur above dull, face densely hairy..... *M. laniger*

93. **Myotis myotis ancilla** Thomas

Myotis myosotis ancilla Thomas, Abstract Proc. Zool. Soc. London, April 26, 1910, p. 25; Proc. Zool. Soc. London, 1910, p. 636; *ibid.*, 1911, p. 688.

Type specimen:—An adult male, skin and skull, No. 10.5.2.4, British Museum, from Shangchow, southeastern Shensi, China. Collected November 27, 1909, by Malcolm P. Anderson.

Description:—Smaller than the European *M. myotis*, and paler in color, with shorter ears. The color above is nearly "drab" of Ridgway, instead of wood brown as in the typical form, the head grayer; dark shoulder patches more strongly defined, blackish brown; lower surface as in the typical race, grayish white, the hairs everywhere with dark slaty bases.

Skull slightly smaller than in the European animal, the bullæ smaller in correlation with the shorter ears. In its general form the skull of this species is relatively slender, with rather narrow brain case and zygomata. The two small premolars stand quite in the tooth-row, the middle upper one the smallest; the upper molars have practically no hypocone, and the protocone is low and without protoconule.

Measurements:—The type measured: head and body, 75 mm.; tail, 56; foot, 12; ear, 21; forearm, 61 (range 59-62).

Skull: greatest length, 22.2 mm.; basi-sinual length, 17; front of canine to back of m^3, 9.2.

Occurrence and Habits:—The above description is taken from Thomas's original account, which was based on a series of three males and a female taken at Shangchow, in southeastern Shensi (see Thomas, 1910b; 1911e). He regards this as the eastern representative of the large *Myotis* of Europe, although its relationship to the Indian *M. blythi* is still uncertain. Although the typical form seems to be a species of central and southern Europe, ranging eastward, the few records for eastern Asia seem to be well to the northward. Thus, in addition to the locality in southeastern Shensi mentioned, the only other seems to be Tuntzia-inzia, east of Dalai Nor, at the south end of the Great Khingan, and so perhaps just outside Mongolian territory (Bobrinski, 1929). The two males collected here by Putiata are in the Zoological Museum of the Academy of Sciences at Leningrad and agree in details of measurement with those given by Thomas.

Specimens examined:—None.

94. **Myotis altarium** Thomas

Myotis altarium Thomas, Abstract Proc. Zool. Soc. London, February 14, 1911, p. 3; Proc. Zool. Soc. London, 1911, p. 161.

Type specimen:—An adult female, skin and skull, No. 11.2.1.9, British Museum, from Omei Shan, Szechwan, China. Collected August 2, 1910.

Description:—A medium-sized species, forearm 45 mm., with remarkably shortened rostrum, recalling somewhat *M. pequinius* in this respect.

Ears "nearly as long as in *bechsteini*, but rather narrow," that is, reaching several millimeters beyond the nose when laid forward, their inner edge evenly convex, outer slightly concave above, convex in lower half, with a strong antitragus separated by a deep notch. Tragus long, not very sharply pointed, evenly but slightly curved outward, and with a well-marked lobule at the outer base. Feet large, but not disproportionately so; calcar long, extending rather more than half-way to the tail, with a very narrow postcalcaneal lobule. Membranes naked, interfemoral not fringed.

The fur is rather long, but thin in the summer pelage, the hair of the back about 8 mm. in length. General color above, uniform "dull brown," paler than "Prout's brown," the tips of the hairs rather lighter, under surface hardly paler than the upper except that the tips of the hairs are more distinctly lighter.

The skull differs from that of the usual *Myotis* in the shortened rostrum, which is broad and evenly narrowed forward, instead of being nearly parallel-sided. In profile the outline of the skull is nearly straight from its highest point to the level of the small premolars, then abruptly concave with a short and slightly upturned nasal region. The palate is unusually vaulted. The small first and second upper premolars both stand in the tooth row, the second about half the size of the anterior tooth.

Measurements:—The type specimen measured: head and body, 55 mm.; tail, 48; ear, 22; tragus on inner edge, 8; third finger, metacarpal, 40; first phalanx, 13.3; combined tibia and foot with claws, 29.

The skull measured: greatest length, 15.2 mm.; basi-sinual length, 12; breadth of brain case, 7.9; front of canine to back of m^3, 6.5.

Occurrence and Habits:—Hitherto this species has been identified from the type locality only, Omei Shan in central Szechwan, where in August, 1910, the original series of five males and four females (no doubt from a roosting colony) was secured by Malcolm P. Anderson, Dr. J. A. C. Smith and Mr. F. Kingdon Ward. The description has been taken from Thomas's (1911d, p. 161) account, which gives all that is known of this bat. He notes that "it is a most peculiar species and readily recognizable by its size, long narrow ears, and the unusual shape of its skull, which differs considerably from that of most members of the genus, although another Chinese species, *M. pequinius*, shows an approach to it."

Specimens examined:—None.

95. **Myotis chinensis chinensis** (Tomes)

Vespertilio chinensis Tomes, Proc. Zool. Soc. London, 1857, p. 52. Swinhoe, *ibid.*, 1870, p. 618.
Myotis chinensis G. M. Allen, Amer. Mus. Novitates, no. 85, p. 5, 1923.

Type specimen:—The type is in the collection of the British Museum, sent from South China by Robert Fortune, a botanical collector, about 1850.

Description:—A large species, forearm about 66 mm. The general color of the upper parts of the body is a uniform dark olive brown, becoming smoke color on the muzzle, the hairs everywhere slaty at the base. Below, the throat, chest, and central parts of the abdomen are uniformly dark gray, the hairs fuscous at the base and minutely tipped with gray; sides of the body dark blackish brown.

The general proportions of the body are about as in smaller members of the group, with large ears extending when laid forward about to the tip of the nose; the calcar is very long and slender, without a keel; at the base of the fifth finger, ventrally, there is a prominent membranous slip extending from the wrist to the base of the metacarpal.

The skull has the general slender form characteristic of most of the genus. In the upper jaw the second small premolar is drawn slightly in from the tooth row. The upper molars lack a distinct protoconule, and approach somewhat the condition in the *Myotis myotis* group. The hypocone is very indistinctly marked, and hardly forms more than a shoulder of the protocone.

Measurements:—Tomes gives the following measurements of the type: head and body, 95 mm.; tail, 55 mm.; forearm, 64 mm.

CRANIAL MEASUREMENTS OF *MYOTIS CHINENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
				M. chinensis chinensis					
60215	23.3	20.0	12.7	15.0	11.5	9.6	9.3	10.2	Fukien
24244 MCZ	22.6	19.4	12.6	——	11.0	8.7	9.0	9.7	Chekiang
24245 MCZ	23.2	20.2	12.6	15.2	11.0	9.8	9.0	10.3	Chekiang
				M. chinensis luctuosus			with incisors		
56867	24.0	22.5	13.4	15.5	11.5	9.7	11.5	12.2	Szechwan
56871	23.7	21.5	13.0	15.5	11.1	9.0	11.5	12.0	Szechwan

Occurrence and Habits:—This large bat is very little inferior in size to the European *Myotis myotis*, to which it may prove more closely allied than at present believed, for in the loss of protoconules and in the great reduction of the hypocones of the upper molars, it seems to show points of relationship. Its dark under side, with minute gray tips to the hairs, contrast, however, with the more extensively whitish under side of that species.

Tomes first described this bat on the basis of a single skin sent by Robert Fortune, a botanical collector, from "China." His work was chiefly in southern China, so that the specimen probably came from some point near the coast of that part of the country, possibly from Shanghai, where he obtained other bats. The typical form probably ranges over the lowland country of southern China, and is replaced in the western hill country of eastern Szechwan by a race lacking the definite broad black band along the sides of the body. Apart from the eastern specimens listed below, I have seen none from other localities, except a single one secured by the American Museum's expedition in extreme southwestern Yunnan, at Yungchangfu, thus extending the range quite across southern China. Nothing seems to be recorded of its habits.

Specimens examined:—In all, five, as follows:

Chekiang: Tunglu, 2 (M.C.Z.).
Fukien: Yenping, 1; no definite locality, 1 (skin only).
Yunnan: Yungchangfu, 1.

96. **Myotis chinensis luctuosus** G. M. Allen

Myotis chinensis luctuosus G. M. Allen, Amer. Mus. Novitates, no. 85, p. 5, August 28, 1923.

Type specimen:—An adult male, skin and skull, No. 56867, American Museum of Natural History, from Wanhsien, Szechwan, China. Collected October 12, 1921, by Dr. Walter Granger, Central Asiatic Expeditions.

Description:—Similar in general proportions and coloring to the typical form, but differing in having the under surface almost uniformly gray instead of with a prominent black stripe along the sides of the body. Color above, a uniform grayish brown, nearly "buffy brown" of Ridgway, the top of the head somewhat darker smoky; below, uniformly gray, the hairs fuscous at their base and minutely tipped with whitish, resulting in an evenly frosted appearance, darkened by the bases of the hairs showing through.

The skull and teeth do not differ from those of the typical form in southern China, except in being a very little smaller, as indicated by the few available specimens of the latter.

Measurements:—Two specimens, the type and a topotype, show the following measurements, those in the first four columns taken by the collector in the flesh.

No.	Head and body	Tail	Foot	Ear	Forearm	Third Mc.	Fourth Mc.	Fifth Mc.
56867	80	65	16	21	65	64	62	59
56871	89	65	16	22	66	61	59	57

The skull measurements of the same two specimens are given in the table preceding.

Occurrence and Habits:—This is perhaps a race of the interior part of China, extending to the western highlands. The series secured by the Central Asiatic Expeditions at Wanhsien, in eastern Szechwan, constitutes all that I have seen, and is very uniform in the reduction of the blackish area along the sides. A. B. Howell (1929, p. 15), however, has recorded it from Changshowkai, Hunan, and Hwangtsaopa, in Kweichow; the single specimen he mentions from Yenping, Fukien, should doubtless be referred to the typical race of the coast.

This seems to be a cave-inhabiting species, for Dr. Granger secured the Wanhsien series in a cave where several species of bats were hibernating.

Specimens examined:—In all, ten, from Wanhsien, Szechwan, including 3 in alcohol, 5 skins and skulls, 2 skins.

97. **Myotis formosus rufo-niger** (Tomes)

Vespertilio rufo-niger Tomes, Proc. Zool. Soc. London, 1858, p. 79, pl. 60 (Mammalia).
Vespertilio formosus Dobson, Cat. Chiroptera Brit. Mus., p. 311, 1878.
?*Miniopterus schreibersi* Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 4, 1930.

Type specimen:—The type is in the British Museum, as part of the Tomes Collection, and is the specimen recorded by Dobson (1878) as the one figured by Tomes. It was collected at Shanghai, Kiangsu, China, by Robert Fortune, between 1850 and 1860.

Description:—This is a fairly large species for the genus, with a forearm of about 49 mm. Ears narrowly ovate, tragus long and obtusely pointed, with a small basal lobule. Wing membrane from the base of the toes. Fur extending out on to the upper side of the humerus, and below covering the membrane about to a line joining the elbow and the knee.

Color remarkable for the bright orange-rufous of the entire body, this coloring extending out on the membranes so as to include all but the tips of the ears, and in a broad line along each side of the fingers and the basal part of the wing and tail membranes. That is, the only parts of the membranes of a brownish black are: the fore part of the antebrachial membrane, two large triangular spaces between the third and fourth and the fourth and fifth digits of the wing, as well as the outer part of the wing membrane from the ankle forward, in a triangle extending nearly to the base of the fifth finger. The tail membrane is also orange. Lower surface of the body slightly paler.

Measurements:—No measurements are available.

This bat is remarkable in the genus for its handsome orange coloring, with the same hue extending out along the fingers and covering much of the wing membranes as well as the interfemoral, so that Bianchi (1917) has proposed for the species the subgenus *Dichromyotis*.

Occurrence and Habits:—The Chinese form of the Orange-colored Bat was first recorded by Tomes (1858) on the basis of a specimen collected at Shanghai by the botanist Fortune and a second from "Kiang." He mentions that he had at first regarded these as different from the typical *M. formosus* of India, and had intended to name the Chinese form *Vespertilio rufo-niger*, but decided that the difference in the intensity of coloring was hardly important as a specific distinction, though it might represent an eastern "race." The Shanghai specimen is figured in his colored plate (Tomes, 1858, pl. 60, Mammalia), and is mentioned by Dobson (1878) as in the British Museum. It is, therefore, to be regarded as the type specimen. That this bright coloring is associated with tree-living habits is shown by the fact that Swinhoe (1870c, p. 617) found a cluster of about ten hanging in the leafy branches of a tree in Formosa, while the single specimen secured by the Central Asiatic Expeditions was found by Mr. Pope's Chinese hunter, Da Da, hanging from a bush

on a low mountain in the thickly settled region of Futsing, Fukien, in October, 1924. Unfortunately, its skull was not preserved. What is doubtless this same species is the specimen recorded by Shih (1930, p. 4) as *Miniopterus schreibersi* subsp., but described as having the orange and black pattern of *Kerivoula picta*. It came from Loshiang, in the Yao Shan district of Kwangsi. The general distribution seems, therefore, to be limited to the warmer parts of southern China, just as the Indian form is found in the warm parts of that country.

Howell (1929) questions the validity of this race, since the slight differences in the ear described by Tomes do not hold for Formosan specimens, but the color differences, if found constant, may suffice to characterize it.

Specimens examined:—One skin from Futsinghsien, Fukien.

98. **Myotis pequinius** Thomas

Myotis (Leuconoë) pequinius Thomas, Proc. Zool. Soc. London, 1908, p. 637.
Capaccinius pequinius Bianchi, Annuaire Mus. Zool. Acad. Sci., Petrograd, for 1916, vol. 21, p. lxxviii, 1917.

Type specimen:—A male, skin and skull, No. 8.8.7.2, British Museum, from thirty miles west of Peiping, Hopei, China. Collected October 11, 1907.

Description:—A comparatively large species, forearm about 50 mm., with a fringed interfemoral membrane.

Fur rather short and velvety, about 5 mm. long in the middle of the back; above "drab gray," the bases of the hairs slaty; below, whitish gray, the ends of the hairs nearly white, their bases slaty. Under side of legs and the anal region, edging the membranes, white and practically hairless. Ears medium, rather narrow; tragus short, about half the height of the ear, curving outward above, narrow but not sharply pointed. Wings from the lower end of the tibiæ; interfemoral membrane fringed with pale buffy hairs, its outer border slightly marbled with white. The skull in profile has a peculiarly upturned, shortened rostrum, according to Thomas. The middle upper premolar is minute, as is also the corresponding one of the lower jaw. In one of the two known specimens, however, this tooth is lacking.

Measurements:—The type measured in the flesh: head and body, 62 mm.; tail, about 42; hind foot without claws, 12; ear, 18. In the dried skin, the tibia is 18; third metacarpal, 46; forearm, 50 (in a second specimen, 48.5).

The skull of the type measured: "basi-sinual" length (to the hind edge of the notch at back of palate), 14.5 mm.; zygomatic width, 12.2; breadth of brain case, 4.7; front of canine to back of m^3, 6.9.

Occurrence and Habits:—Except for the two original specimens taken in a cave thirty miles west of Peiping, nothing further seems to be known of this bat, the above description of which is taken from Thomas's account. He mentions that these specimens were occupying the cave in company with

a colony of *Miniopterus*, an association of genera sometimes found in southern Europe.

Specimens examined:—None.

99. **Myotis daubentonii** (Kuhl)

Vespertilio daubentonii Kuhl, Ann. Wetterau. Ges. Naturk., vol. 4, pt. 2, p. 195, 1819.

Type specimen:—Not known to be in existence. It was from Hanau, Hessen-Nassau, Germany.

Description (after Miller, 1912, p. 184):—Recognizable by its small size, forearm about 35 mm., large foot, more than half the length of the tibia, and by the naked upper surface of the legs.

About the size of *M. mystacinus*, the ear moderately long, extending when laid forward one or two millimeters beyond the muzzle; foot decidedly more than half the length of the tibia; wings from the side of the metatarsus; tragus about half as high as the ear, its tip rather blunt; metacarpals evidently graduated from third to fifth, the third slightly shorter than the forearm; calcar long and slender, without keel on the posterior border; tail about as long as body without head. Fur slightly shorter and more dense than in *M. mystacinus*, wood brown above, buffy gray below.

The skull is as small as that of *M. mystacinus*, but with broader rostrum, palate and brain case, lower occipital region and deeper rostrum, the greatest width of brain case slightly more than half greatest length of skull; the teeth slightly smaller than in *M. mystacinus*, and differing in having in the upper molars a small but distinct protoconule on the anterior commissure of the protocone.

Measurements:—Miller gives the following for European specimens: head and body, 43 mm.; tail, 34; tibia, 17; foot, 11; forearm, 37; third finger, 62; fifth finger, 49; ear, 13.

Skull: condylobasal length, 13.8 mm.; zygomatic width, 9.0; lachrymal breadth, 5.0; breadth of brain case, 7.8; depth of brain case at middle, 5.4; maxillary tooth row, 5.2; mandibular tooth row, 5.6.

Occurrence and Habits:—This small brown bat, though superficially resembling *M. mystacinus*, may be distinguished at once by the relatively large feet, as well as by the other characters given. It corresponds to some extent to the North American *M. lucifugus*, and like it has a distinct protoconule on the upper molars. It is a species of the temperate parts of the Old World, from Sweden to the Mediterranean region in Europe, extending eastward probably to the Pacific, following the tree growth apparently wholly to the north of the desert regions of central Asia. It is included here chiefly on the evidence of its presence in northern Mongolia, furnished by Bobrinski

(1929, p. 225), who records specimens in the Zoological Museum of the Russian Academy of Sciences as follows: (1) one from the River Toi, Kosso Gol, northwestern Mongolia; (2) a second specimen from the Kosso Gol; (3) one from River Halhen, northwestern Mongolia; (4) one from Urto-tamir, Hangai, northern Mongolia; (5) one from Sangin, near Urga, Mongolia. These localities indicate that in Mongolia, like so many other northern species, it occurs as far south as the edge of the scattered forest bordering the grasslands of the northern Gobi. There seems to be no evidence of its presence south of this area.

Specimens examined:—None.

100. **Myotis fimbriatus** (Peters)

Vespertilio fimbriatus Peters, in Swinhoe, Proc. Zool. Soc. London, 1870, p. 617. Dobson, Cat. Chiroptera Brit. Mus., p. 298, 1878.

Myotis hirsutus A. B. Howell, Proc. Biol. Soc. Washington, vol. 39, p. 139, 1926; Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 15, 1929. Yenping, Fukien.

Type specimen:—The type is a skin in the British Museum, collected at Amoy, Fukien, China, by Robert Swinhoe.

Description:—A small bat with dull brown lustreless fur, and relatively large hind feet; tibiæ hairy.

Size medium, forearm about 40 mm., foot stout, about 10.8 mm., including the large pale claws, fur rather short and dense, of a dull grayish brown above, hardly darkening at the bases of the hairs; below, the hairs have dark slaty bases, with ashy-brown tips, except at the anal region where there is a small patch of hairs white to the base. Backs of the tibiæ hairy; calcaneum without a keel.

The skull is considerably larger than that of *M. laniger*, with proportionately larger canines. The upper molars have a small but evident protoconule, and the small premolars are not crowded inward from the tooth row.

Measurements:—Howell (1929) gives the average measurements of twelve specimens as follows: head and body, 48 mm.; tail, 39; ear, 15; forearm, 39; foot, 10.4; tibia, 15.1.

SKULL MEASUREMENTS OF *MYOTIS FIMBRIATUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Width across molars	Mastoid width	Upper cheek teeth	Lower cheek teeth	Locality
60226	15.2	12.1	8.0	9.0	5.6	7.6	7.0	7.7	Fukien
Average of 12 (after Howell)	15.1	——	6.6	——	——	7.5	——	——	Fukien

Occurrence and Habits:—This bat, as Howell (1929) remarks, may be the representative of the European *M. capaccinii* in eastern Asia, to which it seems allied in the characters of the skull, the large heavy feet and the hairy upper surface of the tibia. There is apparently no patch of hair at the elbow.

This is another species that Consul Robert Swinhoe found common at Amoy, whence he sent specimens to Peters at Berlin for identification. The latter determined that it was undescribed and named it *Vespertilio fimbriatus* in Swinhoe's paper. Swinhoe apparently sent three specimens to the British Museum, one in alcohol and two as skins. One of these Dobson (1878) lists as the type and states that it is in a "very imperfect state of preservation." In 1926, A. B. Howell redescribed the same species as *Myotis hirsutus*, overlooking the earlier description. He records thirteen specimens in the U. S. National Museum from Yenping, Fukien, and there are others from there in the American Museum of Natural History. It is evidently colonial in habit, and was doubtless secured in the well known cave at Yenping.

Specimens examined:—In all, four, of which one is an old specimen from Amoy in the M.C.Z., and three from Yenping, Fukien, in the A.M.N.H.

101. **Myotis mystacinus mystacinus** (Kuhl)

Vespertilio mystacinus Kuhl, Ann. Wetterau. Ges. Naturk., vol. 4, pt. 2, p. 202, 1819.
Vespertilio montivagus Dobson, Journ. Asiatic Soc. Bengal, vol. 43, pt. 1, p. 237, 1874; in Anderson, Anat. and Zool. Researches Western Yunnan, p. 98, 1879. Hotha, Yunnan.
Myotis montivagus Trouessart, Cat. Mamm. Viv. Foss., p. 91, 1904.

Type specimen:—Probably not in existence (from Germany).

Description:—For a minute description of the typical subspecies, see Miller, "Mammals of Western Europe" (1912, p. 169). Recognizable by its small size (forearm 35 mm.), combined with short foot, and wing membrane inserted at the base of the outer toe. Ear moderately long, extending, when laid forward, 1 or 2 mm. beyond the nose, tragus narrow, pointed, about half as high as the ear; third, fourth, and fifth metacarpals subequal, falling short of the elbow by about 3 mm., when the wing is folded. Foot about half as long as tibia, the wing membrane inserted at the base of the outer toe. Calcar long and slender, with practically no keel.

Color above, light yellowish brown, the hairs with a distinct gloss, their basal three-fourths slaty; below, similar but less bright, the tips of the hairs gray with a tinge of yellowish.

Skull slender and delicate, breadth of brain case more than that of rostrum but slightly less than half the greatest length. The small first and second premolars alike in form, but the second decidedly the smaller and more or less drawn inward from the line of the tooth row. The first and second upper molars are practically without hypocone, nor is the protoconule developed. In the lower jaw the first and second premolars are considerably smaller than the third, and the second again shows a tendency to be drawn inward from the line of the others.

Measurements:—Miller (1912) gives the following dimensions of European

specimens: forearm, 32-35 mm.; third finger, 49-56; tibia, 15; hind foot, 7.6-8; head and body, 44; tail, 40.

A specimen from Eastern Tombs measured: head and body, 43 mm.; tail, 35; ear, 12; foot, 6.8; tibia, 15.2. The cranial measurements of the same specimen are: greatest length, 14 mm.; basal length, 11.6; palatal length, 6.0; zygomatic width, 8.0; mastoid width, 7.0; width across molars, 5.5; upper cheek teeth, 5.0; lower cheek teeth, 5.8. The dimensions are not essentially different from those given by Miller for European specimens.

The type specimen of Dobson's *Vespertilio montivagus* from Hotha, Yunnan, which I have placed in the synonymy of this species, was measured by him as follows (inches reduced to millimeters): head and body, 46; tail, 40.5; foot and claws, 8.0; ear, height, 15; breadth, 7.0; forearm, 38; tibia, 15.

Occurrence and Habits:—This is in general a bat of the north temperate parts of Europe and Asia, extending nearly to tree limit in the north. Its precise status in the east has been rather uncertain, but at least it seems uncommon, while its subspecific reference has been also doubtful. The American Museum Asiatic Expeditions secured a specimen at Eastern Tombs, Hopei, which, although in alcohol so that its exact coloring is difficult to make out, is nevertheless probably to be referred to the typical race. Its ears reach forward to about the end of the nose; the forearm is 32.5 mm., and the wing arises from the base of the toes. The metacarpals are very slightly graduated, the third about 0.5 mm. longer than the fourth. Its measurements, given above, are practically those of the European animal, and it seems otherwise quite the same. A skin in the American Museum, from "North China," is also apparently this, as well as a specimen in alcohol from Yenping, Fukien. In the southwest of China, Thomas has recorded (1923, p. 656) a *Myotis* "near *M. mystacinus*," from 10,000 feet, on the Likiang Range of Yunnan, indicating that the species covers a wide area across the northern two-thirds or so of China; and from a careful perusal of Dobson's description of "*Vespertilio montivagus*," I have little doubt that this name is a synonym of *M. mystacinus*, and a second record of the species for the highlands of western Yunnan. Dobson's specimen came from Hotha, where it was collected by Anderson in the course of his work there in the early '70's. The diagnostic points of the description appear to be: the small feet, wings from the base of the toes, small forearm, 38 mm., and the position of the minute upper middle premolar in the angle between the first and third premolars. In other respects the length of foot and tibia and the general body measurements agree closely, as does the description of the color. It may be supposed that in this southern part of its range the species inhabits the uplands and hence has followed the high country south into this part of Yunnan. In case future collections show that the color or other characters are different from those of the European form, Dobson's

name may be available in a subspecific sense. In the northeast, it apparently follows along the wooded area of northern Mongolia, for Bobrinski (1929, p. 224) records three in the Museum of the Russian Academy of Sciences, as follows: (1) a male in alcohol from Uliassutai, northwestern Mongolia, collected by Potanin; (2) one from near Urga, at a place called Tsummode, August 14, 1924, collected by Kozlov; (3) one from Tintsa-intsa east of Dalai Nor, at the south end of the Great Khingan Range.

Nothing is recorded of its habits in China.

Specimens examined:—Three, as follows:

Hopei: Eastern Tombs, 1, in alcohol.
Fukien: Yenping, 1, in alcohol.
"North China": 1 skin.

102. **Myotis mystacinus przewalskii** Bobrinski

Myotis mystacinus przewalskii Bobrinski, Compt. Rend. Acad. Sci. URSS, 1926, ser. A, p. 95; Annuaire Mus. Zool. Acad. Sci. URSS, vol. 30, p. 219, 1929.

Type specimen:—A skin and skull, No. 13906, Zoological Museum of the Academy of Sciences, Leningrad, U. S. S. R., from the valley of the Moldja River, on the north slope of the Russian Range, Khotan-tag, southern Kashgaria. Collected May 4, 1885, by Przewalski.

Description:—A pallid desert form of *M. mystacinus*. This is structurally similar to the European race, but pale ochraceous above, in contrast to the more ochraceous tone of the latter, the hair with the same silky gloss; below, the tips of the hairs are pale grayish white instead of decidedly gray. The bases of the hairs above and below are slaty.

No skulls are available for comparison, but the characters doubtless are much the same as in the typical race. According to its describer, the anterior upper premolar is smaller than the outer incisor; the middle premolar is minute and drawn in from the tooth row so as to be invisible from the outside, while the first and third premolars are in contact; in the lower jaw, the middle premolar is likewise minute and lies on the inner side of the tooth row, leaving the first and third premolars in contact.

Measurements:—No measurements of fresh specimens are available. A skin from Shansi has the forearm 34.5 mm.; tibia, 15; foot, 7.

The skull has been figured in outline by Bobrinski (1929) but no measurements are available.

Occurrence and Habits:—This appears to be a pallid, desert race of the common *M. mystacinus* of Europe, differing chiefly through its paler tawny coloration above, and whitish instead of dusky lower surface. But Miller (1912) notes that the European form is "occasionally almost whitish" below. Although described from Kashgaria, and believed by Bobrinski to be limited

to that area, it seems likely that it cannot be satisfactorily separated from the form occurring in the drier parts of Turkestan, southern Mongolia, and the provinces of Kansu, Shensi, and Shansi bordering the Gobi. Indeed, Bobrinski himself (1929, p. 221) records specimens in the collection of the Academy of Sciences at Leningrad, "of *przewalskii* type" in alcohol, from the Chansai River, western Nan Shan, from Hotin Gol near Dinyuanin, west slope of the Alashan, and from Ucheten Gol Pass, west slope of Alashan, evidently not distinguishable, collected by Roborovski and Kozlov, and even describes as new the subspecies *M. m. kukunorensis* from the Hwang Ho south of Koko Nor, on the ground of darker color and larger size. There probably should be referred to *M. m. przewalskii* a series of five skins (lacking skulls) in the collection of the American Museum of Natural History, from Maitaichao, forty-three miles east of Paotow, Shansi, which seem to correspond in pale coloring to the Turkestan bat as described by Bobrinski; no doubt, too, the specimen recorded by Thomas (1909, p. 964) from Paotehchao, Shansi, is the same. Bats are rare in this semiarid area, and the specimen was the only one seen by the collector, M. P. Anderson. Eastward, this desert race doubtless intergrades with the typical form or something very nearly identical, and still farther east, with the saturate form, *M. m. gracilis* Ognev, from Vladivostok. The form *M. m. brandtii* Eversmann of western Asia is apparently recognized by Ognev but must be very close to the typical *mystacinus*.

Specimens examined:—Five (skins only) from Maitaichao, forty-three miles east of Paotow, Shansi.

103. **Myotis laniger** (Peters)

Vespertilio laniger Peters, in Swinhoe, Proc. Zool. Soc. London, 1870, p. 617.
Vespertilio fimbriatus Dobson, Cat. Chiroptera Brit. Mus., p. 298, 1878 (part).
Myotis sowerbyi A. B. Howell, Proc. Biol. Soc. Washington, vol. 39, p. 138, 1926; Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 16, 1929. Yenping, Fukien.

Type specimen:—Swinhoe procured a specimen of this bat at Amoy, Fukien, and sent it to Peters, whose description was published in Swinhoe's account of the mammals of South China. Dobson (1878) lists it as in the British Museum.

Description:—A small dark-brown species, forearm about 35 mm., foot about 8 mm., slightly more than half the length of the tibia, calcaneum not obviously keeled, metacarpals slightly graduated, wing membrane from the base of the toes, upper part of ears narrowed, face densely hairy.

The general color above is a dull dark drabby brown, near "iron gray" of Ridgway; below, the fur is everywhere dark at base, tipped with brownish across the chest, and with paler grayish in the center of the abdomen. The lustreless fur and its relative shortness, the dull sooty-gray tint, and the

densely hairy face without bare area surrounding the eye are the obvious external characters of this species, and distinguish it at once from *M. mystacinus* of somewhat similar general appearance.

Skull: the upper molars show a distinct protoconule in front view; the small premolars stand wholly in the tooth row without crowding, and in one case are even slightly spaced; the upper canine has a small posterior cingulum cusp.

Measurements:—No measurements of fresh specimens are at hand. The forearm in two specimens from Fukien is 34 and 35 mm. respectively, the hind foot 7.6 and 8 mm.

A. B. Howell (1929) gives the following average measurements of fifteen specimens in alcohol: head and body, 41.3 mm.; tail, 38.6; ear, 12.3; forearm, 34.8; foot, 7.9; tibia, 15.

CRANIAL MEASUREMENTS OF *MYOTIS LANIGER*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
84837	13.6	11.0	6.5	—	6.8	5.2	4.9	5.2	Fukien
84838	13.7	11.5	6.7	—	7.2	5.1	5.0	5.1	Fukien
84839	13.0	10.7	6.5	—	6.9	5.0	4.8	4.9	Fukien
84840	13.0	10.6	6.5	—	7.0	5.1	4.8	5.0	Fukien
84841	13.5	11.0	6.0	8.0	7.0	5.1	4.9	5.1	Fukien
85262	13.2	11.9	6.0	9.0	7.0	5.9	5.0	5.5	Hainan

Occurrence and Habits:—This small sooty-colored bat seems to be characteristic of the warmer parts of southern China, and in its short and rather dense fur recalls the *M. austro-riparius* of the southeastern United States. Swinhoe secured one at Amoy, Fukien, and sent it to Peters at Berlin for identification. The latter regarded it as a new species, the description of which he sent to Swinhoe for inclusion in the latter's account of mammals observed in South China, published in 1870. Dr. R. C. Andrews secured a series at Yenping, Fukien, and Mr. Clifford H. Pope collected others in the northwestern corner of the province, at Chunganhsien. He also obtained a pair in alcohol, from Nodoa, Hainan, the first record for the island. In addition, I have referred to this species a skin and skull collected by the American Museum Asiatic Expeditions at Tengyueh, in southwestern Yunnan, a record which extends the known range to the western part of China.

In 1926, Mr. A. B. Howell described as *Myotis sowerbyi* specimens of this same bat from Yenping, apparently overlooking the previous description of Peters. He further records a specimen from Foochow, indicating the general distribution of the species along the coast region of southern China. Dobson, who examined both the type of this and of *M. fimbriatus*,

regarded the latter as a synonym of *M. laniger*, but they are really quite distinct, as Peters showed.

Specimens examined:—In all, thirty-three, as follows:
Fukien: Yenping, 18 (10 in alcohol); Chunganhsien, 12.
Hainan: Nodoa, 2.
Yunnan: Tengyueh, 1.

104. **Myotis frater** G. M. Allen

Myotis frater G. M. Allen, Amer. Mus. Novitates, no. 85, p. 6, August 28, 1923.

Type specimen:—An adult male in alcohol, No. 48039, American Museum of Natural History, from Yenping, Fukien, China. Collected August 10, 1920, by Rev. H. R. Caldwell.

Description:—A small species (forearm 39) structurally similar to *M. volans* of western North America, but differing in details as follows: Tail long as in *M. volans*, about one-half the total length; tibia very long, exceeding that of *M. volans;* the foot much less than half its length, provided with a low but evident keel at about the length of the tarsus from the ankle. Wings ample; the metacarpals graduated, the third longest but falling short of the elbow by about 1.5 mm. when folded. Ears short, barely reaching the muzzle when laid forward, their tips less abruptly rounded off than in *M. volans*. Tragus similar in both, short, its anterior edge slightly concave, its lower half broad, the posterior upper margin slightly crenulate and abruptly beveled off to the tip.

On the lower side the fur extends thinly on the wing from a line from the middle of the femur quite to the elbow, as in the American species. The color is not evident in the alcoholic specimens, but is apparently dark reddish brown.

The skull closely resembles that of the American species in its short upturned rostrum, elevated forehead (as seen in profile), and slightly inflated brain case. As in the American species, the temporal ridges, after uniting anterior to the occiput, diverge, and are continued back to the lambdoid crests as convex, not concave lines. The teeth are small and weak, and the second small premolar is much crowded inward from the tooth row, instead of being practically in the row as in the American form, and it is proportionally as well as actually smaller. In the lower jaw, the second premolar in the same way is more reduced in size and crowded a very little inward from the tooth row.

Measurements:—The type measured: total length, 94 mm.; tail, 47; foot, 8; ear from meatus, 11; forearm, 39; tibia, 20; leg from knee to end of claw, 29.

Skull: greatest length, 13.5 mm.; basal length, 13.2; palatal length, 6.6;

maxillary width, 5.9; zygomatic width, 9.2; mastoid width, 8.0; maxillary tooth row, 5; mandibular tooth row exclusive of incisors, 5.4.

Occurrence and Habits:—This interesting little bat appears to be the counterpart of the western American *M. volans*, or long-legged bat, with which it agrees in most of the important details of structure, though with even more lengthened tibiæ and more progressive dentition, in that the minute middle premolar of both jaws has gone farther on its way toward suppression. The less-progressive American species may thus have been derived from this Asiatic species. The three specimens on which it was based remain unique. They were taken in holes of live bamboo stems on the mountains near Yenping, Fukien, at about 2,500 feet altitude.

The bats of this group are distinguished by the combination of short ears, long tibiæ and small feet with keeled calcar, fur extending to the elbow ventrally, and by the inflated skull, with short rostrum, elevated occiput, and convex outline of the temporal ridges at the occiput.

Specimens examined:—Three in alcohol, including the type, from Yenping, Fukien.

105. **Myotis muricola moupinensis** (Milne-Edwards)

Vespertilio moupinensis Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 253, pl. 37A, fig. 2; pl. 37C, fig. 4, 1868-74.
Vespertilio muricola Hilzheimer, Abh. u. Ber. Mus. f. Natur- u. Heimatk., Magdeburg, vol. 1, p. 184, 1906. Dobson, Cat. Chiroptera Brit. Mus., p. 316, 1878 (in part).
Myotis moupinensis Thomas, Proc. Zool. Soc. London, 1911, p. 162.

Type specimen:—The type was collected by Père Armand David in Muping, central Szechwan, China, and sent to the Paris Museum where it presumably still is.

Description:—Readily distinguished among Chinese bats by its small size (forearm 33), very small delicate feet, and keeled calcaneum.

Fur long and silky, and of characteristic color; above, the center of the back is yellowish brown or bronzy, the hairs with long burnished tips, while the sides of the upper part of the body are dark blackish brown to sooty; below, the hair is everywhere dark slaty at the base, tipped minutely with ashy. The appearance of the dorsal side is thus peculiar in showing three stripes, the central bronze area and the dark smoky stripe on each side.

The feet are smaller and more delicate than in other small Chinese bats, measuring half the length of tibia; the calcaneum has a distinct lobe or keel; wing membrane from the base of the toes; ear delicate and fairly long, with a narrow tip marked off by a sharp notch from the basal portion.

The small delicate skull has a sharply rising forehead in profile, brain case not flattened, and of oval form in dorsal aspect. The teeth show no trace

of protoconule in the upper molars, nor do the latter have the hypocone at all well separated from the protocone. The small first and second premolars above and below are not crowded but stand each in the tooth row.

Measurements:—A specimen from Likiang measured in the flesh as follows: head and body, 40 mm.; tail, 38; hind foot, 7.5; ear, 12; forearm, 33.

The skull measures: greatest length, 13.0 mm.; basal length, 11.0; palatal length, 6.6; zygomatic width, 8.0; mastoid width, 6.6; width across molars, 5.2; upper tooth row, 6.0; lower tooth row, 6.0.

Nomenclature:—This small bat was described from Muping as a distinct species, by Milne-Edwards, but it is evidently very closely related to *M. muricola* (Hodgson) of India, if indeed it is really separable. Thomas (1911d, p. 162) says that it is distinguished from the latter by the sharp notch in the outer edge of the ear, but this character does not seem very trenchant, nor is it obvious in skins. Nevertheless, I have retained the Chinese form as a subspecies. This bat is particularly interesting as probably a close ally of the *M. californicus* group of western North America, whose present northward range now extends to the extreme southern coast of Alaska. One may suppose that at some time in possibly the Pliocene, when eastern Asia was connected by land with western North America, these bats ranged continuously across, but with the subsequent break of this connection and lowered temperatures to the northward, the members of the group on both sides of the Pacific have retreated somewhat to the southward, or at least were exterminated in the north. They agree in the very small delicate foot, with keeled calcaneum, the origin of the wing membrane from the base of the toes, the delicate and narrowed ear, in the long silky pelage and its unusually dark-based fur, with bright contrasting tips, as well as in the formation of the skull, the lack of protoconules in the upper molars, and the intimate union of protocone and hypocone.

Occurrence and Habits:—This small bat is now known from various localities across the southern half of China, exclusive of the area south of latitude 25°. It was first recorded from Muping, in Szechwan, and Thomas (1911d) again reported it from very near the same region, namely, one from Tatsienlu and two from Yinchinwan, Szechwan. The American Museum Asiatic Expeditions have extended its known range considerably to the southwest, for in 1916 two specimens were taken at Ssushanchang, Likiang, Yunnan. Eastward it has been recorded from Kiukiang, in northern Kiangsi (Hilzheimer, 1906), and a single specimen was secured by the Central Asiatic Expedition at Foochow, Fukien. It is apparently not a common species, and the few specimens taken seem to be scattered individuals; yet in India Dodsworth has recorded *M. muricola* as colonial, sometimes living in bungalows, as the

specific name implies, and at Simla apparently to some degree hibernating or at least withdrawing from the shelter of the house during the cooler part of the year. He found females with a single young one in May and June there.

Specimens examined:—In all, three, as follows:

Fukien: Foochow, 1 (in alcohol).
Yunnan: Likiang, 2.

106. **Myotis davidii** (Peters)

Vespertilio davidii Peters, Monatsb. Kön. Preuss. Akad. Wiss. Berlin, 1869, p. 402. Swinhoe, Proc. Zool. Soc. London, 1870, p. 618.
Myotis davidii J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 488, 1906. A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 15, 1929.

Type specimen:—The type was collected at Peiping, Hopei, China, by Père David, and is in the Muséum d'Histoire Naturelle at Paris.

Description:—The type specimen is described as resembling the common European *M. daubentonii*, but distinguishable by the internal position of the second small premolar in each jaw and the origin of the wing membrane from the base of the toes.

Color described by Dobson (*ex* Peters?) as dark with light-brown tips to the fur above, below similar but with gray or ashy tips to the dark-based hairs. Probably, however, the specimen was in alcohol, and its precise coloring, therefore, somewhat indeterminable. J. A. Allen describes a Hainan specimen referred to this species as having the upper parts "nearly black frosted with whitish tips instead of dark with light brown tips." In this type of coloration, it is, therefore, peculiar among bats of this genus.

The feet are rather large; the wing membrane is from the base of the toes, the calcaneum long, extending slightly more than half-way to the tip of the tail. The two terminal vertebræ of the tail project free.

The skull is characterized by the position of the small second premolar internal to the tooth row in each jaw, so that the upper first and third premolars are closely approximated, but in the lower jaw separated by a slight space.

Measurements:—The measurements of the type as given by Dobson, and converted into metric units, are as follows: head and body, 41.4 mm.; tail, 30.0; hind foot, 8.4; ear, 15.3; tragus, 7.0; forearm, 31.7; third finger, 43; fifth finger, 35.5; tibia, 12.6; calcaneum, 18. The specimen from Hainan recorded by J. A. Allen had a forearm of 34 mm.

Occurrence and Habits:—Very little seems to be known about this bat. The type specimen from Peiping was doubtless in alcohol, so that its colors may be incorrectly described, for a second example, taken at Rintoi, on the island of Hainan, a skin and skull, while otherwise agreeing in general, seems

to be unique among eastern bats of this genus in its blackish coloring, with a scattering of white-tipped hairs, giving it a slightly frosted appearance. The withdrawal of the second minute upper premolar wholly inside the tooth row, and a closely similar condition in the case of the corresponding lower tooth, seem to be characteristic. In addition to these records, Hilzheimer (1906, p. 184) mentions that ten were sent to the Magdeburg Museum from Kiukiang, northern Kiangsi, and A. B. Howell (1929, p. 15) adds the note of a specimen in the U. S. National Museum from Hsinlungshan, Hopei. Of the latter, the color is said to be a trifle darker than *M. daubentonii*. It may eventually prove to be a close relative of the latter, and J. A. Allen has suggested (1906, p. 488) that the Hainan specimen may represent a geographically different form.

Specimens examined:—None.

Genus **Rickettia** Bianchi

Rickettia Bianchi, Annuaire Mus. Zool. Acad. Sci., Petrograd, for 1916, vol. 21, p. lxxviii, 1917, as a subgenus of *Capaccinius* (= *Myotis*). G. M. Allen, Journ. Mammalogy, vol. 17, p. 168, May 14, 1936 (raised to generic rank).

This genus is evidently a specialized offshoot of *Myotis*, which in general it resembles in the number and structure of its teeth. It is, however, widely different in the proportions of the hind foot and tibia, and in the point of attachment of the wing membrane to the tibia. The feet are of relatively enormous size. Inclusive of the large and strongly curved claws, the hind foot equals the tibia in length, while the wing membrane, instead of arising from the base of the toes as usual in *Myotis*, or from the ankle as in a few of the species of that genus, takes origin from the ventral side of the tibia, about half-way of its length. This leaves the lower limb unusually free. The teeth are essentially as in *Myotis* but the hypocones of the upper molars are more reduced and there is no protoconule such as is present in some of the smaller species, sometimes referred to *Leuconoë* as a subgenus or even a genus. The outer upper incisor has a conspicuous inner cusp, rather more prominent than in *Myotis*. The resemblance of *Rickettia* to *Pizonyx* of the Gulf of California region is rather striking, but it lacks the gland-like structure in the outer part of the wing membrane and the feet are much more hairy; moreover, the insertion of the wing membrane of *Pizonyx* is different, in that it continues ridge-like to the dorsal surface of the outer side of the metatarsus. The type of the genus and the only species hitherto recognized is *Rickettia pilosa* (Peters).

107. **Rickettia pilosa** (Peters)

RICKETT'S BIG-FOOTED BAT

Vespertilio (*Leuconoë*) *pilosus* Peters, Monatsb. Kön. Preuss. Akad. Wiss. Berlin, 1869, p. 403. Dobson, Cat. Chiroptera Brit. Mus., pp. 285, 289, 1878.

Vespertilio (Leuconoë) ricketti Thomas, Ann. Mag. Nat. Hist., ser. 6, vol. 14, p. 300, 1894.
Myotis pilosus Trouessart, Cat. Mamm. Viv. Foss., p. 89, 1904. Miller and G. M. Allen, Bull. U. S. Nat. Mus., no. 144, p. 208, 1928.
Capaccinius ricketti Bianchi, Annuaire Mus. Zool. Acad. Sci., Petrograd, for 1916, vol. 21, p. lxxviii, 1917.

Type specimen:—The origin of the type and its present whereabouts remain unknown. Peters based his original description on a specimen in the Muséum d'Histoire Naturelle at Paris, and gave its locality as Montevideo, Uruguay. It was an adult female in alcohol, but appears now to have been lost sight of; at least, M. J. Berlioz of the Muséum, in response to inquiries on the part of G. S. Miller, Jr., and myself, wrote that he could neither discover the specimen nor find any mention of it in the Muséum catalogue. Since no other specimen has ever been reported from South America, and since Chinese specimens agree exactly with Peters's description, there seems no reason to doubt that it came instead from eastern China, whence in 1894 Thomas obtained a skin and skull, collected by C. B. Rickett. Believing it a new species, he named it in honor of the donor, who had secured it in Fukien, at Foochow.

Description:—Fur short, close and velvety. Muzzle well clothed with bristly whiskers. Hind legs, both above and below, the ankles, feet and calcar covered with rather conspicuous short stiff hairs; basal half of interfemoral membrane also hairy. Ears when laid forward not reaching the tip of the muzzle. Tragus rather short and narrow, less than half the height of the ear. Thumb with a long slender claw; calcar very long, extending four-fifths the way to the tail, the terminal vertebra of which is free.

Color of the entire upper surface drab, slightly darker on the sides of the head. Under surface white, the bases of the hairs plumbeous.

Skull rather slenderly proportioned, with a slight sagittal ridge, relatively small audital bullæ, and slender zygomata which bow outward posteriorly to form an angle. Upper incisors large, each with a conspicuous secondary cusp. First upper premolar low, its point hardly projecting above the cingulum of the canine; second premolar much smaller, its crown area barely half that of the first, both teeth very slightly internal to the axis of the tooth row. Lower incisors imbricate, the two inner pairs with their crowns trifid as seen from in front; the outer lower incisors conspicuously larger, showing only two cusps from in front, but in crown view a third is seen behind them forming a blunt elevation.

Measurements:—A skin in the American Museum of Natural History has a forearm length of 55 mm. An alcoholic specimen in the Museum of Comparative Zoölogy measures: forearm, 56.5 mm.; head and body, 65 (ca.); tail, 50 (ca.); foot with claws, 20; ear, 19; tragus, inner margin, 6.8; tibia, 20; calcar, 21.5. Thomas records for the type of his *Vespertilio ricketti:*

forearm, 58 mm.; head and body, 69; tail, 48; ear, 18; tragus, inner margin, 6.2; third finger, 94; calcar, 18.

The skull of the second of these specimens measures: greatest length, 21.3 mm.; basal length, 18.0; palatal length, 11.5; zygomatic width, 14.0; mastoid width, 10.6; width across molars, 8.9; upper cheek teeth, 8.5; lower cheek teeth, 10.9.

Occurrence and Habits:—Little is recorded of this bat. So far as present information goes, however, it is found on the eastern coast from Fukien to Shantung. Following the description of the species in 1869, under an erroneous locality, the next specimens recorded are two from Foochow, Fukien, one taken in April, the other in November, 1894. The former served as the type of *Vespertilio ricketti*, named by Thomas for the collector, and both are in the British Museum. The American Museum Asiatic Expeditions secured a third record, namely, a skin without skull, from Shaowu, Min River, Fukien. More recently I have reported (G. M. Allen, 1936) the capture of this species at Suchow, lower Yangtze, by Dr. C. C. Liu, who secured two specimens, one of which is in the Museum of Comparative Zoölogy, the other in the Field Museum of Natural History. Unfortunately no field notes accompany any of these. Since then I have had the opportunity of examining a skin in the British Museum, received in 1926, and representing part of a "batch" of 56 of these bats brought in at Taianfu, Shantung. This is at once the most northerly record of the species, as well as the only report of its presence in numbers.

The large foot, long and strong calcar for spreading the interfemoral membrane, the rather short tail, the reduction of the wing attachment so as to give freedom to the leg, are all characters recalling those in *Noctilio* and *Pizonyx*, and very likely indicate that like them, *Rickettia* has fish-eating habits and uses its strong feet for hooking small fish from close to the surface. Unfortunately no clue to the food habits could be secured from Dr. Liu's specimens, for the intestines of both were empty.

Specimens examined:—Four:

Fukien: Shaowu, Min River, 1; Foochow, 1 (B.M.).
Anhwei: Suchow, 1 (M.C.Z.).
Shantung: Taianfu, 1 (B.M.).

Genus **Pipistrellus** Kaup

Pipistrellus Kaup, Skizzirte Entw.-Gesch. u. Naturl. Syst. d. Europ. Thierw., vol. 1, p. 98, 1829.

The bats of this genus are small, some of them extremely so, and may usually be distinguished by their small ears, which are proportionally broader than in *Myotis*, their short blunt tragus which projects slightly forward, and by their otherwise generally unmodified exterior. The feet are small and

delicate; the tail is wholly included in the membrane, except for the extreme tip; the wing shows no shortening of the fifth finger. The skull is somewhat broader proportionally than in *Myotis*, and there is one less tooth in each jaw, for the minute middle premolar of the latter is quite lost in *Pipistrellus* and the space closed. The outer upper incisor is smaller than the inner, and the latter in the eastern forms has a small secondary cusp. The lower canine is short and stout, while the upper sometimes shows an incipient cusp at the posterior base. The tooth formula is: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{2}{2}$ m.$\frac{3}{3}$ = 34.

Notwithstanding that various names have been assigned to bats of this genus from China, further study is needed before the species can be correctly estimated. So similar in size, general appearance, and cranial characters are they that it is frequently impossible to identify poorly preserved specimens or those in alcohol in which color is not apparent. More recently Thomas has shown that the males of at least two of the eastern species are readily recognizable by the wide differences in the baculum or penis bone. Until a thorough study of the group as a whole can be made, the following determination of species must be regarded as wholly provisional. The type species of the genus is the European *Vespertilio* (=*Pipistrellus*) *pipistrellus*.

KEY TO CHINESE SPECIES OF *Pipistrellus*

A. Color nearly black above, lightly sprinkled with whitish..... *P. pulveratus*
B. Color grayish or brownish.
  a. Grayish brown above, baculum long with double curve..... *P. abramus*
  b. Dark brown above, baculum shorter and straight..... *P. tralatitius tramatus*

108. **Pipistrellus pulveratus** (Peters)

Vesperugo pulveratus Peters, in Swinhoe, Proc. Zool. Soc. London, 1870, p. 618.
Vesperugo maurus Dobson, Cat. Chiroptera Brit. Mus., p. 218, 1878 (in part).
Vesperugo pulverulatus Trouessart, Cat. Mamm. Viv. Foss., p. 112, 1897 (*errori m*).
Pipistrellus savii pulveratus Thomas, Proc. Zool. Soc. London, 1898, p. 771.
Pipistrellus pulveratus A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 17, 1929.

Type specimen:—A skin in the British Museum, from Amoy, China, collected by Robert Swinhoe, previous to 1870.

Description:—Size fairly large for the genus, forearm about 35 mm., general color blackish, minutely frosted with pale gray or white above and below.

The color above is darker than below, a deep blackish brown, with a scattering of pale-tipped hairs, which, however, hardly suffice to give more than a slightly frosted effect to the middle of the back; below, the pale tips are longer and more abundant, evenly frosting the lower surface.

Ears fairly large for a *Pipistrellus*, tragus short, broad and bluntly rounded.

Wings from the base of the toes, fur of the body not extending out on to the membranes.

In the skull, the upper and inner incisor of each pair are about equal in length, the inner bifid, with the secondary cusp on the outer side and directed slightly backward. The upper small premolar is internal to the tooth row but visible between the first and third premolars, which are nearly in contact.

Measurements:—The measurements of the type, as given by Peters, and of other specimens follow.

No.	Total length	Tail	Hind foot	Ear	Forearm	Locality
(type)	85	—	8	12.5	34	Fukien
44678	84	38	8	12.0	36	Fukien
84844	—	—	7	——	33	Fukien
85013	83	37	8	14.0	36	Yunnan

CRANIAL MEASUREMENTS OF *PIPISTRELLUS PULVERATUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
44678	14.2	12.0	6.8	7.6	7.0	5.5	5.8	6.0	Fukien
84844	14.9	11.5	6.5	8.5	7.4	5.6	——	——	Fukien
85013	——	——	6.6	8.7	——	6.0	——	——	Yunnan

Nomenclature:—This bat is easily recognized among Chinese species of the genus by its size and the light sprinkling of pale hairs on a dark background. It was first made known by Peters on the basis of a specimen captured by Swinhoe at Amoy, Fukien. This specimen is in the British Museum, listed by Dobson in his "Catalogue of the Chiroptera" under *Vesperugo maurus*, a European species, of which he considered the name *P. pulveratus* a synonym. Thomas (1898) later regarded it as an eastern race of *Pipistrellus savii*, of which *Vesperugo maurus* is in turn a synonym. Very likely Thomas's view is correct, but for the present it may be better to use the binomial until a thorough study can be made of all the Asiatic members of the genus.

Occurrence and Habits:—So far as available records go, this bat seems to be confined to the warm portions of southern China. In addition to the original locality, Amoy, in southeastern Fukien, Thomas (1898) has recorded it from the northwestern corner of the same province at Kuatun, and a second was secured near the same place by Clifford H. Pope, at Chunganhsien. Dr. R. C. Andrews procured a few at Futsing, eastern Fukien, in late July, 1916, probably from a small breeding colony, as they are immature. Still farther south, Mell (1922, p. 14) has recorded the capture of one in Lackpass Forest, in the Canton region of Kwangtung. From the coast of southeastern China, it apparently ranges westward quite across the country, for Dr. Andrews brought back a skin from Likiang and another from Makaihsien, in Yunnan, and Howell

(1929) mentions others from Suifu, Szechwan, and Pingkiang, Hunan. Dobson (1878) lists Peiping as a locality for it, but this is doubtless a mistake. Beyond these records little more seems to be known of the species.

Specimens examined:—In all, nine, as follows:
Fukien: Chunganhsien, 1; Futsing, 5 (young); Amoy, 1 (M.C.Z.).
Yunnan: Likiang, 1; Makaihsien, 1.

109. **Pipistrellus abramus** (Temminck)

Vespertilio abramus Temminck, Monogr. de Mammalogie, vol. 2, p. 232, 1835.
Vespertilio irretitus Cantor, Ann. Mag. Nat. Hist., ser. 1, vol. 9, p. 481, 1842. Chusan Island, Chekiang.
Scotophilus pumiloides Tomes, Proc. Zool. Soc. London, 1857, p. 51. ?China.
Vesperugo abramus Swinhoe, Proc. Zool. Soc. London, 1870, p. 618.
Myotis abramus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 488, 1906 (*lapsus calami*).
Scotophilus pomiloides (*sic*) Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 14, 1922.
Pipistrellus abramus Thomas, Proc. Zool. Soc. London, 1928, p. 143.

Type specimen:—The original specimen is from Nagasaki, Japan, and may still be in the Leiden Museum, Holland.

Description:—Size small, forearm about 32 mm., wing membrane from the base of the toes; a low but distinct keel on the calcar. Penis bone long, 10 mm., slender, with a double curvature.

General color above a dull sandy brown over the back, becoming dark brown on the head; hairs of the lower surface dark-based, with dull gray tips. Females may be slightly browner.

Skull: the outer upper incisor may equal the tip of the cusp of the inner, or it may be minutely longer or shorter, even on opposite sides of the same skull.

Measurements:—

No.	Length	Tail	Hind foot	Ear	Forearm	Locality
7199 MCZ	82	37	9	—	34.0	Hupeh
7219 MCZ	88	40	8	—	33.0	Hupeh
7197 MCZ	72	32	8	—	——	Hupeh
7205 MCZ	87	27	7	—	31.5	Hupeh
56927	73	34	—	11	33.5	Hopei
58284	80	35	8	11	34.0	Szechwan

CRANIAL MEASUREMENTS OF *PIPISTRELLUS ABRAMUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
7209 MCZ	12.2	10.9	6.1	——	7.0	5.4	5.5	6.0	Hupeh
7210 MCZ	12.8	10.6	6.1	——	7.3	5.5	5.4	5.7	Hupeh
7212 MCZ	12.8	11.0	5.9	——	7.2	5.0	5.3	5.7	Hupeh
7213 MCZ	12.7	10.5	5.7	8.5	7.5	5.5	5.4	6.0	Hupeh
7214 MCZ	12.6	10.9	5.8	——	7.0	5.3	5.4	5.5	Hupeh
44680	13.1	11.5	6.3	8.3	7.3	5.4	5.5	6.0	Fukien
56927	13.4	11.5	6.6	8.5	7.4	5.0	5.7	5.9	Hopei

Nomenclature:—Several small species of this genus inhabit the warmer parts of Asia and Europe, but are so similar in general appearance that it is not always easy to identify specimens. Lately, however, Thomas showed that the size and shape of the baculum or penis bone affords an excellent means for distinguishing the males. The baculum of *P. abramus* is remarkable for its length and the double sigmoid curve. Until a more thorough treatment of all the Old World species can be undertaken, however, most of the older identifications must be disregarded. Contrary to the opinion I had previously formed, Thomas regarded *P. tralatitius* as a species distinct from *P. abramus*, a deduction that is doubtless correct. Following my suggestion, A. B. Howell (1929) had recorded this bat as a northern subspecies of the former, and applied *P. pumiloides* to southern animals. I have examined the series, on one specimen of which J. A. Allen (1906, p. 487) based his *P. portensis* from Hainan, and found the specimens to be immature, and hence dark in coloring; they are probably closely related to the following species. Cantor in 1842 described as *Vespertilio irretitus* what is doubtless this same bat from the island of Chusan, off the mouth of the Yangtze. Nevertheless, if it should later prove that the Japanese form is different from that of North China, his name will apply to the latter. Temminck explains that the specific name is from the Japanese word "abramusi (insecte du lard)."

Occurrence and Habits:—This is a common species in eastern China, from Eastern Tombs and Peiping in Hopei, south through Shantung to at least Fukien and Hainan, and westward to the borders of Szechwan. It is a house bat, frequently making small colonies in dwellings, and at night coming in about the lamps for insects. Swinhoe (1870a) mentions such a colony under the eaves of a house in Hainan where he lived. He adds that the Chinese Gazetteer calls it "Foo-yeh" or "belly-wings," but it is also called "Feishoo" or Flying Mouse.

A specimen from Shenchowfu, Hunan, contained three embryos.

Under *Pipistrellus* sp.? both Sowerby (1912, p. 172) and A. B. Howell (1929, p. 17) have recorded this genus from Kansu, but in each case the specimen was unsatisfactory for determination.

Specimens examined:—Forty-seven, as follows:

Hopei: Eastern Tombs, 11; Weihsien, 4.
Shantung: Chimo, 9.
Fukien: Yenping, 2; Futsing, 8.
Szechwan: Wanhsien, 3.
Hupeh: Ichang, 6.
Hunan: Shenchowfu, 1.
Hainan: 3.

110. **Pipistrellus tralatitius tramatus** Thomas

Pipistrellus coromandrus tramatus Thomas, Proc. Zool. Soc. London, 1928, p. 144.

Type specimen:—Adult male, in spirit, No. 25.1.1.120, British Museum, from Thai-Nien, Tongking, French Indo-China. Collected March 30, 1924, by Herbert Stevens.

Description:—Size small; forearm, 30 mm., baculum small and approximately straight, about 4 mm. long. General color dark brown, slightly brighter brown below, with a minutely peppered appearance, due to the extremely small paler tips of the hairs, hardly visible without a lens.

Skull length about 12 mm. According to Thomas, this form hardly differs from typical *P. coromandrus* except in the more delicate build of the skull.

Measurements:—Thomas gives the following measurements: head and body, 38 mm.; tail, 28.5; ear, 10.5; tibia and foot, 16.

The skull of the type measures: greatest length, 11.8 mm.; condylobasal length, 11.4; breadth of brain case, 6.1; mastoid breadth, 6.6; upper cheek teeth, 4.1.

This species, which superficially resembles *P. abramus*, may now be at once distinguished by the very different baculum, which is practically straight, tapering in side view from base to tip, and about 4 mm. long. The color is probably consistently different, a more chocolate brown.

Occurrence and Habits:—The range in China probably includes the more southern portions, but the only specimen that I would positively refer to it at present is one from Yenping, Fukien, which shows the characters indicated, and carries the known range northward from Tongking. Probably, however, a few specimens from southern Yunnan are the same.

Specimens examined:—Fukien: Yenping, 1.

Genus **Ia** Thomas

Ia Thomas, Ann. Mag. Nat. Hist., ser. 7, vol. 10, p. 163, 1902.

This genus contains but the single species, *Ia io*, a "gigantic Serotine," probably the largest of the vespertilionid bats. According to Miller (1907), it is closely related to *Scotozous*, which in turn is similar to *Pipistrellus*, differing chiefly in the reduced outer upper incisor. In *Ia* the form of the upper outer incisor is still different, being flat-crowned, with a well-developed cingulum and "barely indicated central elevation"; in the first and second upper molars the mesostyle is less prominent, "barely extending outward to line joining the extremities" of the two other styles, instead of exceeding them as in other related genera. The tooth formula as in *Pipistrellus* and *Scotozous* is:

$i.\frac{2}{3}$ $c.\frac{1}{1}$ $pm.\frac{2}{2}$ $m.\frac{3}{3} = 34$. The canine is strongly in contact with the large premolar above, while the small premolar (pm^3) is minute, visible only with a lens, and is hidden away in the angle between the two.

The wing in *Ia* shows an approach to the condition in *Nyctalus*, in the shortening of the fifth finger, so that its tip reaches about to the end of the second third of the basal phalanx of digit 3.

111. Ia io Thomas

Ia io Thomas, Ann. Mag. Nat. Hist., ser. 7, vol. 10, p. 164, 1902.

Type specimen:—The type is a skin and skull, No. 2.6.10.2, British Museum, from Changyang, southern Hupeh, China. Collected January 13, 1902, by F. W. Styan.

Description:—A large dark-colored bat, forearm about 70 mm. General color above a uniform sooty brown; face nearly naked. A small tuft of dark bristle hairs marks a submental gland. Under parts dark grayish brown, the hairs everywhere dark brown at the base, indistinctly paling to grayish brown at the tips. Wings from the ankles; tip of tail slightly projecting from the membrane. Feet proportionally large and strong, a little longer than half the tibia, with long claws. Fifth metacarpal considerably shorter than the third and fourth but the total length of the fifth finger nearly equal to the length of the former plus half the first phalanx. Ears relatively short, not longer than the head, densely haired near the tip inside. The tragus is like that of *Nyctalus*, short, its greatest breadth about three-fourths its length on the inner margin, which is straight, while the outer margin is convex. The tip is bluntly rounded.

The skull is proportionately large and stout, the rostrum rather evenly flattened above, the occiput distinctly elevated above the fore part of the brain case, and with a strongly overhanging sagittal crest which continues forward as a low sharp ridge to the interorbital region. The palatal notch extends back about to the level of the posterior border of the canine. The reduced upper outer incisor and the short mesostyle of the upper molars have already been noted as important generic differences from the smaller but allied genera *Pipistrellus* and *Scotozous*. The basial pits at the back of the skull are well marked and deeply excavated, longer than broad. Upper inner incisor with a faint indication of a cusp near the outer tip; lower incisors with trifid crowns, strongly imbricated. Hypocones practically absent in upper molars.

Measurements:—

No.	Head and body	Tail	Foot	Ear	Forearm	Third Mc.	Locality
(type)	104	63	—	24	72	70	Hupeh
56872	89	61	18	25	72	69	Szechwan

CRANIAL MEASUREMENTS OF *IA IO*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
(type)	27.0	——	——	17.0	——	——	——	——	Hupeh
56872	27.2	22.7	12.4	16.7	13.8	11.0	11.8	12.9	Szechwan

Occurrence and Habits:—Despite its large size, this bat seems to be rarely captured, for the first known specimen was not taken until 1902, the type, collected by F. W. Styan at Changyang in southern Hupeh. The Central Asiatic Expeditions secured two others at Wanhsien, Szechwan, where presumably they were found with numbers of other bats in a cave at Yenchingkou, in which several species wintered. Sowerby (1932b, p. 304) speaks of a specimen from Nanking, and Sanborn (1933) has recorded another from Tungwongtien, Kweichow, extending the known range slightly to the south.

Specimens examined:—Two only, from Wanhsien, eastern Szechwan.

Genus **Nyctalus** Bowdich

Nyctalus Bowdich, Excursions in Madeira and Porto Santo, p. 36, 1825 (as a subgenus). Lesson, Nouv. Tableau Règne Anim., Mamm., p. 27, 1842 (as a subgenus of *Vespertilio*).
Pterygistes Kaup, Skizzirte Entw.-Gesch. u. Naturl. Syst. d. Europ. Thierw., vol. 1, p. 99, 1829.
Noctula Gerbe, Le Naturaliste, 2me année, no. 24, p. 187, March 15, 1880 (as a new subgenus of *Vesperugo*).

This genus is evidently related to *Pipistrellus*, with which it agrees in tooth formula. Its members are, however, heavier of body, with somewhat less delicate and proportionately shorter ears. The chief distinguishing external feature is the greatly shortened fifth finger of the wing, the tip of this finger barely exceeding the fourth or fifth metacarpal, whereas in the related genera, the tip of the fifth finger usually exceeds the combined length of the metacarpal and first phalanx (in *Ia* its tip reaches to about the end of the second third of the basal phalanx of the third finger). The notch at the tip of the rostrum is unusually deep, extending back about half-way to the interorbital constriction above, while on the palatal aspect it is unusually large also. The teeth are much as in *Pipistrellus*, but the outer upper incisor is very deeply concave, with a large anterior and small posterior cusp; the canine is in contact with the large premolar, while the small premolar is minute, and usually hidden from external view; upper two anterior molars with small hypocones (Miller, 1907, p. 207).

At least two forms probably occur in China, but their exact relationships are still imperfectly made out.

The type species is the Madeiran Noctule, *Nyctalus verrucosus* Bowdich.

Key to the Chinese Forms of *Nyctalus*

A. Size larger, forearm about 62 mm..... *N. aviator*

B. Size smaller, forearm about 50 mm.
   a. General color darker ..... *N. velutinus*
   b. General color less dark ..... *N. noctula plancyi*

112. **Nyctalus aviator** Thomas

THE LARGER NOCTULE

Nyctalus aviator Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 8, p. 380, 1911.
Vespertilio molossus Temminck, in Siebold, Fauna Japonica, Mamm. (aperçu gén.), p. 15, pl. 3, fig. 3, 1842-45 (not of Pallas, 1767).

Type specimen:—Thomas selected as the type of *Nyctalus aviator*, a male, skin and skull, No. 5.1.4.5, British Museum, from Tokyo, Hondo, Japan. Collected April 30, 1904, by H. Ogawa.

Description:—This is a large bat, resembling the large species of southern Europe, although their relationships may not be close. The fur of the body has the usual plush-like character of this genus and extends out on to the wing membrane along the sides of the body as far as a line connecting knee and elbow. The color above is uniform dark reddish brown; below somewhat lighter, "dead-leaf color."

The skull is large and of the general form as in others of the genus.

Measurements:—The forearm measurement, according to Thomas, is 62 mm. No other fresh measurements are available.

The skull of the type measured: condylobasal length, 21.2 mm.; mastoid width, 14.2; upper cheek teeth (front of canine to back of m^3), 8.5.

Nomenclature:—This bat was first described by Temminck, but his name, *Vespertilio molossus*, was invalidated by its previous use by Pallas. Dobson called it *V. lasiopterus*, but that term is a synonym of the European *N. noctula* probably, although Dobson's specimen referred to that species proved to be *N. maximus* of southern Europe, a bat perhaps somewhat nearly allied to the eastern species. Thomas, therefore, bestowed upon the latter the name *N. aviator*.

Occurrence and Habits:—The only record of the occurrence of this species in Chinese territory seems to be that of Thomas (1911f), who, in renaming the Japanese animal, mentions specimens in addition to his type, from Tokyo and Nagasaki, as well as from Shaweishan Island, off the mouth of the Yangtze River. The latter record extends the range southward from the Japanese archipelago, but otherwise we seem to have very little knowledge of the species, its distribution or relationships.

Specimens examined:—None.

113. **Nyctalus noctula plancyi** (Gerbe)

Vesperugo (*Noctula*) *plancyi* Gerbe, Le Naturaliste, 2me année, no. 24, p. 187, March 15, 1880.
Vesperugo noctula plancyi Trouessart, Le Naturaliste, 2me année, no. 26, p. 202, April 15, 1880.
Noctula plancyi Gerbe, Le Naturaliste, 2me année, no. 26, p. 203, April 15, 1880.
Vesperus sinensis Peters, Monatsb. Kön. Preuss. Akad. Wiss. Berlin, 1880, p. 258. Peiping, Hopei.
Nyctalus noctula sinensis A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 18, 1929 (? in part).

Type specimen:—The type was sent from Peiping, Hopei, China, by V. Collin de Plancy, for whom it was subsequently named. It is presumably in the Paris Museum.

Description:—The original description gives few details of value. The color is said to be brownish black, darker than in the typical form of Europe, the tragus more abruptly curved and more deeply notched on its inner margin; tail not projecting from the membrane; third digit falling 3 or 4 millimeters short of the elbow.

Measurements:—The type is said to have been smaller than the European form, with a (? head and body) length of 65 mm. instead of 75 as in the latter.

Thomas (1912e, p. 129), writing of a specimen from Szechwan, says that *N. n. plancyi* is "just distinguishable—by its rather smaller size—from the Nepalese *N. labiatus* Hodgs., with which it shares the reduced length of the outer incisors." Peters (1880), describing the color of the Peiping example that he named *V. sinensis*, says it is brown above, the hairs dark brown at the base and brighter at their tips; below, pale brown; head and body, 70 mm.; ear, 19; tail, 45; foot, 11; tibia, 18; forearm, 49. His description, published in the Monatsbericht of the Berlin Academy, was read on March 1, 1880, but was probably not issued until the following month, hence is antedated by *Vesperugo plancyi* of Gerbe.

Occurrence and Habits:—This was described from Peiping, in North China, first by Gerbe, and again under the name *Vesperus sinensis*, by Peters. Trouessart suggested that it should stand as a subspecies of *V. noctula*, and Howell, using Peters's name, *Vesperus sinensis*, has followed a similar course, so that it is reasonable to suppose that this is a North China race of the widely distributed noctule bat. No one since seems to have seen specimens from North China, although Thomas (1912e) has recorded as of this form, a specimen from Yachowfu, Szechwan, altitude 2,599 feet, and A. B. Howell (1929, p. 18) another from Hunan (as *N. n. sinensis*). Whether, however, these more southern individuals are the present subspecies, or are members of the dark *N. velutinus*, or even whether this is a valid form, must for the present remain unsettled.

Specimens examined:—None.

114. **Nyctalus velutinus** G. M. Allen

Nyctalus velutinus G. M. Allen, Amer. Mus. Novitates, no. 85, p. 7, August 28, 1923.
Vesperugo molossus Swinhoe, Proc. Zool. Soc. London, 1870, p. 619.
Nyctalus noctula labiata G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 243, 1912.
Vesperus lasiopterus Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 14, 1922.
Nyctalus species A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 18, 1929.
Vesperugo noctula Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 4, 1930.

Type specimen:—An adult male, skin and skull, No. 44649, American Museum of Natural History, from Futsing, Fukien, China. Collected July 29, 1916, by Edmund Heller and R. C. Andrews.

Description:—Smaller and darker than the western *N. noctula*. Color above, Prout's brown; below paler, near Dresden brown, slightly grayer on the chest. The bases of the hairs, both above and below, are darker, about fuscous.

On the dorsal surface the fur of the body extends out as far as a line joining the knee and the proximal half of the humerus, and across the interfemoral membrane nearly to a line joining the middle of the tibiæ. Below, the wing membrane is thickly furred from the knee to the basal third of the fifth finger and at the base of the fourth, as well as on the propatagium and along the under side of the humerus. On the under side of the interfemoral membrane its extent is about like that on the upper side, namely, to a line extending across from the middle of the tibiæ.

Measurements:—In the following list the first four measurements were taken by the collector, the others from the dried skin.

No.	Head and body	Tail	Hind foot	Ear	Fore-arm	Third meta-carpal	Fourth meta-carpal	Fifth meta-carpal	Locality
44649 (type)	75	52	11	15	49.0	49.5	48	39.5	Fukien
44773	—	—	11	—	49.0	49.5	49	39.5	Fukien
24250 MCZ	—	43	11	18	50.5	52.0	50	41.0	Chekiang
24238 MCZ	—	39	10	18	50.0	51.0	50	40.0	Chekiang
13258 MCZ	—	36	11	—	49.0	51.0	50	42.5	Szechwan

CRANIAL MEASUREMENTS OF *NYCTALUS VELUTINUS*

No.	Greatest length	Basal length	Palatal length	Zygo-matic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
44649 (type)	18.0	18.3	9.0	——	11.2	8.5	7.0	7.3	Fukien
44773	17.6	15.9	8.6	11.8	11.2	8.0	6.5	7.0	Fukien
7222 MCZ	17.0	14.8	8.0	11.5	10.9	8.0	6.5	6.8	Hupeh
54229 U. MICH.	18.6	16.5	——	12.4	10.6	9.0	7.0	7.6	"China"
55831 U. MICH.	18.5	16.5	9.0	——	10.5	8.9	6.8	7.4	Kiangsu
55832 U. MICH.	17.8	15.8	8.8	——	11.1	8.4	6.7	7.3	Kiangsu

Occurrence and Habits:—Undoubtedly the relationship of the noctule bat of South China is close to that of Europe and northern Asia, and it may later be shown that it is but a subspecies of the latter. Its small size and very dark coloring, however, seem quite distinctive, as well as the shorter outer incisor of the upper jaw, a character it has in common with *N. labiatus* of Nepal, to which I had previously (G. M. Allen, 1912) referred specimens. In this last respect, also, it is like the noctule of North China, *N. n. plancyi*, but not having been able to compare it with undoubted specimens of the latter, I have decided to treat it as a separate species until further studies can be made.

This bat is apparently not very common over southern China, judging from the few specimens available. In the Province of Fukien, whence the type came, the American Museum Asiatic Expeditions secured it at Futsing, Foochow, and Yuki. Two specimens from Tunglu, Chekiang, taken by J. T. Wright in November and March respectively, as well as one from Kweichowfu, eastern Szechwan, and one from Ichang, Hupeh, are in the Museum of Comparative Zoölogy, the last a nearly full-grown but still immature one, taken July 21, 1907. In addition, A. B. Howell (1929) has recorded two immature examples from Mount Omei, central Szechwan, remarking on their apparently small size. It is probably this bat that Swinhoe (1870c) records from Hongkong as *Vesperugo molossus*, and perhaps Mell's (1922, p. 14) record of *Vesperus lasiopterus* from near Canton is the same. No doubt also, it is the same bat of which Shih (1930, p. 4) writes, under the name of *Vesperugo noctula*, that it abounds in the Yao Shan district, Kwangsi, where sometimes as many as twenty may be found by day in the hollow joints of bamboo in the bamboo forests.

Specimens examined:—In all, twenty-five, as follows:

Kiangsu: Nanking, 2 (Univ. Mich.).
Fukien: Foochow, 5; Futsing, 9; no locality, 2; Yuki?, 1.
Chekiang: Tunglu, 3 (M.C.Z.).
Hupeh: Ichang, 1 (M.C.Z.).
Szechwan: Kweichowfu, 1 (M.C.Z.).
"China," 1 (Univ. Mich.).

Genus **Eptesicus** Rafinesque

Eptesicus Rafinesque, Annals of Nature, p. 2, 1820.

The bats of this genus are not very different in external appearance from *Pipistrellus*, except that the muzzle is slightly more blunt with heavy lips, due to the presence of glands on the fore part of the face; the tragus, too, is slightly longer in proportion and more nearly straight with a blunt point,

instead of short and rounded. The skull shows a shallow depression on each side of the rostrum, and the profile is slightly flattened with an even upward slope from the anterior end. The tooth formula shows an advance over that in *Pipistrellus* and *Nyctalus* in the complete loss of the minute upper premolar of these latter, giving: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{1}{2}$ m.$\frac{3}{3}$ = 32. In this group there are large and small forms with a considerable range of size between the extremes, but all may be considered as generically the same. The range includes the temperate and tropical parts of both Old and New Worlds. Three or four forms occur in the limits here considered. The type species of the genus is *Eptesicus melanops* Rafinesque = *E. fuscus* (Beauvois).

KEY TO CHINESE AND MONGOLIAN SPECIES OF *Eptesicus*

A. Forearm 40 mm. or less.
   a. Forearm 40 mm., outer upper incisor obviously shorter than the inner ..... *E. nilssonii gobiensis*
   b. Forearm about 37 mm., outer upper incisor equaling the inner in extent ..... *E. alashanicus*

B. Forearm more than 40 mm.
   a. Forearm about 51 mm.; paler, the bases of the fur not conspicuously darker than the tips ..... *E. serotinus pallens*
   b. Forearm about 56 mm.; darker, the bases of the fur conspicuously darker than their tips ..... *E. andersoni*

115. **Eptesicus nilssonii gobiensis** Bobrinski

Eptesicus nilssoni gobiensis Bobrinski, Compt. Rend. Acad. Sci. URSS, 1926, ser. A, p. 96.
Eptesicus nilssoni centrasiaticus Bobrinski, *loc. cit.* (in part, as to Mongolian specimens).

Type specimen:—An adult male, skin and skull, No. 2135, Zoological Museum of the Academy of Sciences, Leningrad, U. S. S. R., from Burchasteitala in the Gobi Altai.

Description:—A pallid desert race of the north European and Asiatic *E. nilssonii*. There is a slight amount of individual variation in color in a series from the same locality, from nearly "ochraceous tawny" of Ridgway to about "warm buff," the fur everywhere dark blackish brown basally. Below, the bases of the hairs are dark, "mummy brown," their tips white, with an evident contrast of color along the sides of the neck where the buffy upper surface gives place to whitish below.

The skull is smaller than that of *E. serotinus*, with somewhat smoother and more rounded outlines, relatively broader interorbital region, and slightly stouter proportions. The teeth are in general similar, though smaller, the inner upper incisor less slender.

Measurements:—The external measurements of a series of adult females from the Gobi, Mongolia, are taken from the collector's record on the labels.

No.	Head and body	Tail	Hind foot	Ear	Locality
60422	65	45	10	10	Mongolia
60423	58	40	10	14	Mongolia
60427	61	40	10	10	Mongolia
60428	62	41	10	11	Mongolia
60430	64	42	10	14	Mongolia
60432	62	43	10	15	Mongolia
60433	60	40	10	15	Mongolia
60434	58	43	10	13	Mongolia
60442	57	41	10	13	Mongolia
60446	57	45	10	15	Mongolia

CRANIAL MEASUREMENTS OF *EPTESICUS NILSSONII GOBIENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
60423	16.3	14.0	8.0	10.4	9.0	7.0	5.7	6.2	Mongolia
60426	16.1	13.8	8.0	10.1	9.0	6.9	5.9	6.3	Mongolia
60427	16.2	14.0	7.9	10.3	9.0	7.0	5.8	6.5	Mongolia
60432	16.4	14.0	8.0	10.6	8.8	7.0	5.8	6.4	Mongolia
60437	16.2	13.9	8.0	10.2	9.0	6.6	5.7	6.4	Mongolia

Eptesicus nilssonii and its races are readily distinguished from those of the *E. serotinus* group by their smaller size (forearm about 40 mm.) and the strong contrast between the tips and bases of the upper fur, as well as by the evident line of demarcation between the color of upper and lower surfaces at the sides of the neck.

Occurrence and Habits:—The type locality of this pale desert form is Burchasteitala at the eastern end of the Altai Mountains in the Gobi. Its describer, Bobrinski (1926), in the same paper named as additional new subspecies, *E. n. centrasiaticus* and *E. n. kashgaricus*, listing specimens of the former in his later (1929) paper from the following localities in Mongolia and northwestern China: two skins in the collection of the Russian Academy from Orin Nor, Nanshan, collected by Przewalski; an alcoholic from near Shachow, north of the Humboldt Mountains (Kozlov and Roborovski, collectors); two others from the valley of Orok Nor, Sain Noin, central Mongolia (Kozlov); and others obtained by Kozlov from Holt, northwestern Gobi, and Huluetenkuduk, in the northern Gobi. It seems probable from the description and from the localities given that these specimens listed as *E. n. centrasiaticus* are indistinguishable from *E. n. gobiensis*, in which the color variations supposed to separate the two forms are clearly present in the series from Kholobolchi Nor, collected by Dr. Walter Granger of the Central Asiatic Expeditions in the Gobi. These last were from a breeding colony of adult females, for a single young one about a third grown was preserved with them. In addition,

the expedition secured three mummies and an extra skull at Ula Usu, Mongolia. In his second paper of 1929, Bobrinski records as *Eptesicus nilssoni* two males and two females from Suzukte, near Urga, in northern Mongolia, and Kastschenko mentions two females under the same name, taken by Manakin in 1898 on the western slope of the Great Khingan Mountains. It seems more probable that these records refer to *E. n. gobiensis* as well, for the color distinctions on which the diagnosis chiefly rests can hardly be considered wholly reliable, since three of the four specimens are in alcohol.

Specimens examined:—In all, thirty-one, as follows:
Mongolia: Kholobolchi Nor, 27; Ula Usu, 4 (3 mummies, 1 skull).

116. **Eptesicus serotinus pallens** Miller

Eptesicus serotinus pallens Miller, Proc. Biol. Soc. Washington, vol. 24, p. 53, February 24, 1911.
Vesperugo serotinus Buechner, Bull. Acad. Imp. Sci. St. Pétersbourg, vol. 34 (new ser., vol. 2), p. 106 (Mélanges Biol., vol. 13, p. 152), 1892.
Eptesicus serotinus turcomanus Bobrinski, Annuaire Mus. Zool. Acad. Sci. URSS, vol. 30, p. 234, 1929 (in part, as to eastern specimens).
Eptesicus serotinus pallidus Bobrinski, *ibid.*, p. 235 (*errorim* for *pallens*).

Type specimen:—An adult male, skin and skull, No. 155156, U. S. National Museum, from Chengyuanhsien, seventy miles west of Chingyangfu, Kansu, China. Collected August 4, 1909, by Arthur de Carle Sowerby.

Description:—Similar to the typical European form but paler, especially below, skull slightly smaller.

General color above a uniform olive brown, about "Dresden brown" of Ridgway; the bases of the hairs slightly but not conspicuously darker for the first third; below, very pale buffy, in strong contrast to the upper surface, the basal half of the fur on the chest and upper belly with drab bases, that of the throat and posterior abdomen clear.

The skull is hardly different from that of the European *E. serotinus*.

Measurements:—The type measured: head and body, 70 mm.; tail, 50; hind foot, 13.8; ear, 19; forearm, 49; tibia, 22; third finger, 90. The forearms of three other Chinese specimens from Shantung measure: 51, 52, 50, respectively. The cranial measurements of the last two and of the type follow.

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row, c-m^3	Lower tooth row, c-m_3	Locality
33133	21.0	18.8	10.3	14.4	10.5	9.0	7.5	8.4	Shantung
25874 MCZ	18.8	15.5	8.7	12.0	10.0	8.1	7.0	7.7	Shantung
155156 USNM (type)	——	——	——	14.0	——	——	7.2	8.2	Kansu

Occurrence and Habits:—This is the form of the European serotine found across northeastern Asia, intergrading westward undoubtedly with the typical form. To it I have referred the specimens from Mongolia that Bobrinski (1929), who did not have access to Miller's description of *E. s. pallens*, regarded as probably identical with *E. s. turcomanus* of Eversmann. The latter, however, as shown by specimens from the Caucasus region, is a somewhat paler animal, and may be very pale indeed in the desert region of Transcaspia. Bobrinski records nine specimens from the Mongolian desert, as follows: four taken by Przewalski, August 18, 1880, in the southwestern foothills of the Alashan Range; two from the Ucheten Gol Pass, west slope of the Alashan, collected by Kozlov; two from the Uroti district of the southern Gobi, collected by Przewalski; one from the Ordos Desert, Hwang Ho valley, collected by Potanin. Buechner (1892) had previously recorded a specimen from the Ordos, in the valley of the Chuanche not far from Chekou, in the summer of 1884. Sowerby secured two in Kansu in 1909, one at Chengyuanhsien (later made the type of *E. s. pallens*), and one eighteen miles east of Kuyuanchow; as well as two others in Shensi, eighty miles southwest of Yenanfu. These were shot flying around his camp at dusk in the loess country, and all but one are now in the U. S. National Museum. The latter collection also contains two from Tientsin, Hopei, and ten from Tsingtao, Shantung (A. B. Howell, 1929, p. 18). Specimens from Chimo and Weihsien, Shantung, are in the collection of the American Museum, and others from Tsinan in the same province are in the Museum of Comparative Zoölogy.

Howell notes that a specimen from Hopei and an adult from Shantung are somewhat darker below than the type from Kansu, but this may be merely individual variation, for a considerable difference in degree of dark and light is shown by the two specimens from Tsinan. Indeed, the lightest-colored specimens are hardly distinguishable from some specimens of *E. s. turcomanus* that I have seen, except perhaps by the slightly smaller size.

This is evidently a species that may occur in small numbers over a wide extent of rather barren country as in the loess areas of Kansu and Shensi or in the cleared and long-cultivated Shantung peninsula. It does not seem to occur in South China where its place is taken by the much darker-colored *E. andersoni*. Sowerby (1914, p. 54) writes that this is the commonest of the North China bats and may be seen "everywhere during the warmer months, but is most plentiful in the higher country westward from the border of Chihli. . . . It hides during the day in loess cliffs, coming out in the evenings to feed, flying at comparatively great altitudes."

Specimens examined:—In all, eight, as follows:

Shantung: Chimo, 5; Weihsien, 1; Tsinan, 2 (M.C.Z.).

117. **Eptesicus alashanicus** Bobrinski

Eptesicus alashanicus Bobrinski, Compt. Rend. Acad. Sci. URSS, 1926, ser. A, p. 98; Annuaire Mus. Zool. Acad. Sci. URSS, vol. 30, p. 228, text-figs. 4, 5, 1929.

Cotypes:—A female, in alcohol, No. 13945, from the Pass of Hotin Gol, near Dinyuanin, west slope of Alashan Range; and a male, skin, No. 2146, from northern Alashan, on the border of the Uroti district; both in the Museum of the Academy of Sciences, Leningrad, U. S. S. R.

Description:—Above "brownish," the tips of the hairs pale, "vinaceous buff," the middle portion brown; below, like the back but paler, the concealed bases of all the hairs dark brown; membranes black, the outer edge of the wing with a sharply defined pale border.

Tragus somewhat narrower than in *E. caucasicus* with a somewhat better defined basal lobe; tip of tail exserted from the membrane.

The skull of this bat differs from that of *E. caucasicus*, to which it seems closely related, in its slightly greater size. The length of the upper outer incisor, which reaches the same level as the inner instead of being much shorter, distinguishes it at once from *E. serotinus pallens* and *E. nilssonii gobiensis*. The skull in profile is shown in Bobrinski's paper to have a slight convexity above the interorbital region, and lacks any prominent overhang at the vertex.

Measurements:—The following measurements of the cotypes are given by the describer, those of the alcoholic specimen first in each case. Forearm, 37.5, 36 mm.; third metacarpal, 32, 31; fifth metacarpal, 31, 30.5; tail from anus, 39.5, —; lower leg, 15.1, —; foot without claw, 7.9, —; ear, 13, —; tragus, 5.7, —.

Skull: total length, 14 mm., —; condylobasal length, 13.8, —; zygomatic width, 9.2, —; width of brain case, 7, —; upper cheek teeth, 5.2, 5; lower cheek teeth, 5.4, 5.1.

Occurrence and Habits:—The two cotypes of this bat are the only specimens hitherto recorded, one from the Pass of Hotin Gol, west slope of the Alashan, the other from the Uroti district, northern Alashan, indicating a desert habitat for the species. Possibly, however, the specimens from Hunan mentioned by A. B. Howell (1929, p. 18) as smaller and darker than *E. serotinus pallens*, and which he did not definitely refer to any described form, may be this. Judging from Bobrinski's description, it is a darker bat than *E. serotinus*, and in addition to its smaller size is easily recognized by the long outer upper incisor, whose tip extends to the tip of the inner incisor, instead of being markedly shorter as in the other Chinese species. Bobrinski regards it as closely related to *E. caucasicus* of southwestern Asia, but it is somewhat larger. Additional specimens of this bat would be interesting to show its range and relationships.

Specimens examined:—None.

118. **Eptesicus andersoni** (Dobson)

Vesperus andersoni Dobson, Proc. Asiatic Soc. Bengal, 1871, p. 211.
Vesperugo andersoni Dobson, Monograph Asiatic Chiroptera, p. 110, figs. a, b, c, 1876; Cat. Chiroptera Brit. Mus., p. 195, 1878; in Anderson, J., Anat. and Zool. Researches Western Yunnan, p. 101, pl. 4, figs. 2, 6, 1879.
Vespertilio (*Eptesicus*) *serotinus andersoni* Trouessart, Cat. Mamm. Viv. Foss., p. 77, 1904.

Type specimen:—Dobson, writing in 1876, stated that the type was then in the collection of the Indian Museum at Calcutta. It is one of two from Momein or Tengyueh, in western Yunnan, taken by Dr. John Anderson in the course of his Western Yunnan Expedition, probably in 1868.

Description:—Somewhat larger than *E. serotinus*, very dark brown above, paler below; forearm about 53 mm.

In comparison with *E. serotinus*, which this species at first sight resembles, *E. andersoni* may be distinguished by its slightly wider ear, slightly larger foot, longer forearm, and by the fact that the terminal vertebra only of the tail is free instead of the two terminal ones. The color also is very different, with the bases of the fur above and below darker. Above, the general color is a very dark olive brown with a slightly paler appearance across the middle of the back, due to very short pale tips to the hairs of this region. The fur of the back is dark blackish brown for the basal half, and olive brown for the terminal half, without a very noticeable contrast between the bases and tips; below, the basal half of the hairs everywhere is dark slaty, the tips buffy gray. The fur does not extend noticeably out on to the membranes.

The skull is slightly larger and notably more massive than that of *E. serotinus pallens*, with a greater distance between the root of the squamosal and the posterior border of the skull. The outer upper incisor is slightly longer, extending half-way to the tip of the outer cusp of the inner incisor. Otherwise the teeth of *E. andersoni* are not essentially different from those of the latter.

Measurements:—The measurements of two specimens from the type locality and others from eastern China are given below, those of the former converted to metric units.

No.	Head and body	Tail	Foot	Ear	Forearm	Locality
INDIAN MUS.	66.0	48.0	10.2	19.3	55.5	Yunnan
INDIAN MUS.	64.0	48.0	10.2	19.3	55.5	Yunnan
44645	75.0	52.0	12.0	18.0	54.0	Fukien
44654	82.0	49.0	13.0	18.0	57.0	Fukien
24254 MCZ	74.5	47.5	11.5	19.5	57.0	Chekiang
24239 MCZ	71.5	42.0	11.0	18.0	50.0 imm.	Chekiang

CRANIAL MEASUREMENTS OF *EPTESICUS ANDERSONI*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
44645	19.4	17.0	9.7	——	10.1	8.4	7.0	8.0	Fukien
44654	21.7	18.5	10.1	14.5	11.6	9.5	7.9	8.6	Fukien

Occurrence and Habits:—This larger and darker *Eptesicus* seems to replace the more northern *E. serotinus pallens* over South China. It was first discovered by Dr. John Anderson in the course of his first Yunnan Expedition in 1868, when he secured two specimens at Momein, now Tengyueh. These specimens, in the Indian Museum at Calcutta, formed the basis of Dobson's description. Its range probably extends across the warmer parts of China to the eastern coast in Fukien and northward to the mouth of the Yangtze. The American Museum has a series of skins secured by Dr. Andrews and Edmund Heller at Futsing and at Yenping in Fukien, and there are three in the Museum of Comparative Zoölogy (without skulls) from Lanchi, Chekiang. I have seen no specimens from intermediate localities, but its presence across southern China cannot be doubted. Nothing has been recorded of its habits, but it is evidently colonial, for the American Museum's series of both sexes was taken at the same time and place.

Specimens examined:—In all, twenty-six, as follows:

Chekiang: Lanchi, 3 (skins only, M.C.Z.).

Fukien: Futsing, 23 (10 skins and skulls, 2 skulls, 11 in alcohol).

Genus **Vespertilio** Linnæus

Vespertilio Linnæus, Syst. Nat., ed. 10, vol. 1, p. 31, 1758.

The bats of this genus resemble in general those of the genus *Eptesicus*, externally, except that the ear is proportionally shorter and broader, and in coloration the fur is minutely white-tipped, giving a characteristic frosted appearance, which is found rarely in Old World bats. The skull resembles that of *Eptesicus* and has the same tooth formula. It differs, however, in the much larger notch at the anterior end which dorsally extends back nearly halfway to the interorbital constriction, while in palatal aspect it is so large as to be distinctly wider than deep.

Of the old genus *Vespertilio*, in which Linnæus included all the bats known to him, at the present time but a single species remains, *V. murinus* and its subspecies *V. m. superans*. The range in general extends from western Europe quite across Asia to China, in the temperate zone. It is a question whether the typical form may not extend all the way to Manchuria, at least A. B. Howell (1929) records a specimen from that country as indistinguishable from European examples.

119. **Vespertilio murinus murinus** Linnæus

Vespertilio murinus Linnæus, Syst. Nat., ed. 10, vol. 1, p. 32, 1758.

Type specimen:—Not known to exist; the type locality is assumed to be Sweden.

Description:—About the size and proportions of the Serotine Bat of Europe, but with a broader and shorter ear. Wings from the base of the toes; calcar with a low keel; tragus bluntly rounded off at the tip. The fur extends out on the interfemoral membrane as far as a line joining the first third of the tibiæ.

General color above dark blackish brown, the tips of the hairs minutely whitish, giving a hoary appearance to the entire back; on the under side, the center of the chest and abdomen is similarly blackish brown but with longer whitish tips to the hairs, while a band across the throat and on each side of the body from the axilla to the anal region is whitish to the base (description from Russian specimens).

Measurements:—Miller (1912) gives the following measurements of three adults from Denmark:

Head and body	Tail	Foot	Tibia	Ear	Forearm	Third finger
62	43	9.6	17.4	15.0	43.4	73
59	40	9.2	16.8	15.0	44.0	76
62	44	10.0	16.8	15.6	43.0	74

Miller (1912, p. 241) gives also the following dimensions of a skull from Sweden: condylobasal length, 14.8 mm.; zygomatic width, 9.2; lachrymal breadth, 6.2; breadth of brain case, 8.0; maxillary tooth row, 5.2; mandibular tooth row, 5.6.

Occurrence and Habits:—There seems to be some evidence that the typical form of this species extends quite across the continents of Europe and Asia in the north temperate zone without obvious change. At all events, Thomas (Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 500, 1909) so identified a specimen from Manchuria, and A. B. Howell (1929, p. 19) has similarly determined a second from Sansing, Manchuria, as well as a third from eighty-five miles north of Lanchow, Kansu. Very likely the third specimen at least would be found to be quite as near the subspecies *V. m. superans* as to the European animal if sufficient comparable material were available, and the same may be true of yet another record, namely, that of Bobrinski (1929, p. 235), of a specimen from Alyshkan, northern Alashan, taken by Kozlov, May 17, 1909. This example is preserved in alcohol and hence may not be normal in appearance. Bobrinski mentions other specimens of the typical form from Kashgaria.

Specimens examined:—None.

120. **Vespertilio murinus superans** Thomas

Vespertilio murinus superans Thomas, Proc. Zool. Soc. London, 1898, p. 770.
Vespertilio discolor superans De Winton and Styan, Proc. Zool. Soc. London, 1899, p. 573.

Type specimen:—A skin and skull, No. 97.4.21.1, British Museum, said to be from Sesalin (but doubtless the same individual recorded from Sasahu), Ichang, Hupeh, China. Collected by F. W. Styan.

Description:—This race is said to differ from the typical subspecies in its slightly larger size, with a forearm from 4-9 mm. longer. In the series of three at hand, however, there is a noticeable and constant difference in color of the under side, which is uniformly dark brown at the bases of the hairs, minutely tipped with gray, in contrast to two from Russia representing the typical form, in which the throat and sides of the body are contrastingly pure white to the roots of the hairs. In other words, the South China race is uniformly dark brown throughout, both above and below, with only the tips of the hairs whitish and the upper side a trifle darker than the lower, whereas in the European animal there is a contrasted white area on the throat and sides.

The skull is slightly larger than that of the European bat, but otherwise similar.

Measurements:—The following measurements of Chinese specimens are available:

No.	Total length	Tail	Foot	Ear	Forearm	Locality
7513 MCZ	117	46	10	—	46.0	Szechwan
7225 MCZ	99	37	10	—	50.0	Hupeh
19920 MCZ	—	—	10	—	48.0	Shansi
97.4.21.1 BM (type)	—	—	—	—	54.0	Hupeh
85294	—	—	10	—	49.5	Hopei

CRANIAL MEASUREMENTS OF *VESPERTILIO MURINUS SUPERANS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
7514 MCZ	17.3	15.5	8.7	10.8	9.8	7.4	6.8	7.3	Szechwan
7225 MCZ	17.6	15.5	8.7	11.3	10.0	7.1	6.6	7.4	Hupeh
85294	18.0	16.0	6.0	11.7	11.0	8.5	7.0	7.5	Hopei

Occurrence and Habits:—This bat seems to be fairly well distributed over northern China, with much the same range as the serotine, and, though nowhere common, may be looked for anywhere from the Yangtze valley, northward, even in the more desert regions. It is easily recognized by its dark-chocolate ground color above and below, everywhere frosted with the minute whitish tips to the hairs. As already indicated, it possibly intergrades with the typical form in the northern part of its range, as in Manchuria, but the Chinese

specimens that I have examined seem more uniform in their coloring below, without the contrasting white throat and sides.

In the north, A. B. Howell (1929) records a specimen from Tientsin, and the American Museum has one in alcohol from Peiping, Hopei; Bobrinski (1929, p. 239) mentions three skins in the Museum at Leningrad, collected by Przewalski in the north bend of the Hwang Ho, northern Ordos Desert; the specimen from Kansu, referred by Howell to the typical form, may be nearer this as well. Farther south, the type came from Ichang, Hupeh, and the Museum of Comparative Zoölogy has a second specimen from there, and another from still farther west at Kweichowfu, as well as a male that Dr. F. R. Wulsin collected in Shansi, at Pashuiko, seventy miles southwest of Taiyuanfu. Four from Hunan, at Yochow, to the south of the Yangtze, are recorded by A. B. Howell (1929, p. 19), while the most southern record of all is that by Thomas (1898), who says that the La Touche collection from Kuatun, northwestern Fukien, contains six specimens.

Specimens examined:—In all, four, as follows:

Hopei: Peiping, 1.
Hupeh: Ichang, 1 (M.C.Z.).
Eastern Szechwan: Kweichowfu, 1 (M.C.Z.).
Shansi: Pashuiko, 1 (M.C.Z.).

Genus **Tylonycteris** Peters

Tylonycteris Peters, Monatsb. Kön. Preuss. Akad. Wiss. Berlin, 1872, p. 703.

The bats of this genus are extremely small, of a general bright buffy coloring darkened by the brown tips of the hairs; the ears are about as long as the head, the tragus short and bluntly rounded at the tip. In fresh specimens a fleshy pad is conspicuous at the base of the thumb and on the sole of the hind foot, but in dried specimens these are less obvious. The striking feature is the broad and very much flattened skull, whose depth through the audital bulla is barely half the mastoid width. So flattened is the brain case that the skull in profile hardly rises posteriorly. The rostrum is short and wide, its length hardly as great as its breadth, and there is an inconspicuous slight projection at the front edge of the orbit. The tooth formula is the same as in *Eptesicus*, namely: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{1}{2}$ m.$\frac{3}{3}$ = 32. The teeth are not peculiar except that the upper canine has a well-developed secondary cusp on its posterior cutting edge.

The genus is tropical, occurring from India and southern subtropical China to the East Indies and the Philippines. A puzzling diversity in size is found among the otherwise nearly uniformly colored individuals even from the same locality, for some are a trifle larger with longer forearm. Thomas has named the latter *T. robustula* but it seems uncertain if these larger individu-

als really constitute a distinct species. The typical *T. pachypus* was described from Java, and is the type of the genus, perhaps barely distinguishable from the Indian form *fulvidus* which may be regarded as a subspecies.

121. **Tylonycteris pachypus fulvidus** (Blyth)

Scotophilus fulvidus Blyth, Journ. Asiatic Soc. Bengal, vol. 28, p. 293, 1859.
Tylonycteris pachypus Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 14, 1922.

Type specimen:—The type came from Schwe Gyen, on the Sitang River, Tenasserim. It is presumably in the Indian Museum at Calcutta.

Description:—Size very small, forearm 27 mm.; fur everywhere conspicuously pale yellowish buff at the base, tipped with dark brown, which darkens the general coloring, especially over the back and on the chest where the dark tips are longest; on the ventral side the warm buff is yellower and nearly pure across the throat. The wing membranes are from the base of the toes and there is a long low keel on the calcar. The membranes are without fur.

The extraordinarily flattened skull and peculiar upper canines have been mentioned under the generic characters.

Measurements:—A skin from Namting River, Yunnan, was measured by the collector as follows: head and body, 35 mm.; tail, 29; hind foot, 6; ear, 9; forearm, 28.

The skull of this specimen measures: greatest length, 11 mm.; basal length, 10; palatal length, 5; zygomatic width, 8; mastoid width, 7; width across molars, 5; upper maxillary teeth, canine to last molar, 4; lower tooth row, incisor to back of last molar, 4.7.

Occurrence and Habits:—This minute and delicately formed bat is found in the tropical parts of eastern Asia, extending into the subtropical area, and so just reaching the warmer parts of extreme South China. The only record I have of it for eastern China is that of Mell (1922, p. 14), who says that in the Canton region it is found in the mountain forests, chiefly in the bamboos at from 600-900 meters altitude, in latitude 25° north. The usual hiding place of this little bat during the day is in hollow bamboo stems, and Mell records that he once took thirteen from a bamboo joint split on one side in the midst of a forest, and had on four other occasions obtained from three to five specimens in similar situations. Apparently the only record for southwestern China is furnished by three skins taken by Dr. R. C. Andrews and Edmund Heller on the Namting River at the Burma border, southwestern Yunnan, at an altitude of 1,700 feet, in February, 1917. No doubt further search will eventually reveal the presence of this species here and there along the extreme southern border of China. Its very much flattened head is per-

haps an adaptation allowing it to enter narrow cracks and so to obtain access to the hollow interior of bamboo stalks, while the obvious pads under the thumbs and soles of the hind feet perhaps are useful, as Dobson long ago suggested, to enable it to cling to the smooth sides of such places.

Specimens examined:—In all, three, from the Namting River, Burma border, Yunnan.

122. **Tylonycteris robustula** Thomas

Tylonycteris robustula Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 15, p. 227, 1915.

Type specimen:—A female, skin and skull, No. 11.1.18.8, British Museum, from Upper Sarawak, Borneo. Collected by Cecil J. Brooks.

Description:—Similar to *T. p. fulvidus*, but heavier of body with a stouter skull; forearm not larger. The color is said to be dark brown, but little lighter below.

Measurements:—Forearm, 26-28 mm.; head and body, 43; tail, 27.5; foot, 6.3; ear, 10.

The skull measurements are given by Thomas as follows: greatest length, 12.5 mm.; breadth of brain case, 7.6; upper cheek teeth (c-m^3), 4.2-4.4.

Occurrence and Habits:—The characters claimed as separating this from the typical form are of somewhat doubtful value, and it may be that the heavier skull and dark color are individual matters rather than specific, especially as the two forms occur together in Java. A skin and two alcoholic specimens from the Namting River, Burma border, Yunnan, collected at the same locality with the typical specimens of *T. p. fulvidus*, seem a little heavier of skull, and are doubtfully referred to this form.

Specimens examined:—Three, from Namting River, Yunnan.

Genus **Scotomanes** Dobson

Scotomanes Dobson, Proc. Zool. Soc. London, 1875, p. 371 (subgenus of *Scotophilus*); Cat. Chiroptera Brit. Mus., p. 258, 1878 (genus).

This is a monotypic genus containing the single species *S. ornatus*, with its subspecies. It is of fairly large size, and has a characteristic pattern of white markings on a rich brown ground. In its tooth formula it resembles *Nycticeius*, having one incisor only in each premaxilla, and hence showing a reduction over the condition in *Eptesicus* and its relatives in which there are two. The anterior palatal emargination is smaller than in any other member of the family, its greatest depth scarcely more than half the distance between the upper canines. The lachrymal region is somewhat expanded and the anterior edge of the orbit distinctly beaded and angular (Miller, 1907). Tooth formula: $i.\frac{1}{3}$ $c.\frac{1}{1}$ $pm.\frac{1}{2}$ $m.\frac{3}{3} = 30$.

The typical form of this species was from Darjeeling, India, and a dark subspecies (*imbrensis*) has been described from the Khasi Hills, north of Sylhet, Assam. The subspecies of eastern China is somewhat smaller, but otherwise not very different.

123. **Scotomanes ornatus sinensis** Thomas

Scotomanes ornatus sinensis Thomas, Journ. Bombay Nat. Hist. Soc., vol. 27, p. 772, 1921.
Scotophilus ornatus Dobson, Monograph Asiatic Chiroptera, p. 125, 1876. Thomas, Proc. Zool. Soc. London, 1898, p. 771. Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 3, 1930.
Scotomanes ornatus Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 15, 1922.

Type specimen:—A male, skin and skull, No. 97.9.3.1, British Museum, from Kuatun, northwestern Fukien, China, August 21, by J. D. La Touche.

Description:—Size rather large, forearm 60 mm., color rich russet, with conspicuous white markings.

Face from muzzle to ears nearly naked, but with minute dark hairs. Top of head light russet brown, the bases of the hairs slaty, then with a broad whitish area, minutely tipped with russet brown; back similar, but the brown tips are darker and more extensive. A tuft of shining white hair at the middle of the crown; a similar tuft at the front and one at the back of the shoulder, and a white line down the middle of the back. Below, the sides of the body along the membrane are dark rich brown from the front of the wing to the knee; a broad median area of the same from the chin to the root of the tail and a similarly colored transverse collar from the posterior base of the ear around to the opposite side. This leaves a white area on each side of the chin and a broad white stripe from the side of the neck to the base of the interfemoral membrane.

The distinctive characters of the skull have been mentioned in the account of the generic characters.

Measurements:—This race averages smaller than the typical form of eastern India or its dark subspecies of Assam. The forearm measurement of the type is 60 mm., but in other specimens may be less, 50-55 mm.; hind foot of type, 15.3.

CRANIAL MEASUREMENTS OF *SCOTOMANES ORNATUS SINENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
84847	20.2	18.0	10.0	16 (ca.)	—	10.0	8.1	9.0	Fukien

Occurrence and Habits:—According to Thomas this Chinese race of the Ornate Bat is distinguishable by its slightly smaller average size and richer, deeper color (near tawny or ochraceous tawny) from the Indian forms. No doubt, however, intergradation takes place, and it is quite likely that specimens from western China may not easily be distinguished.

This bat was first discovered in China by J. D. La Touche, at Kuatun in northwestern Fukien (Thomas, 1898, p. 771), and his specimen later became the type of the eastern subspecies. Thomas (1921b) also records other specimens from Yenping in the same province, and from Chungking, eastern Szechwan. The American Museum Asiatic Expeditions secured two from Yenping and a single one from Chunganhsien, northwestern Fukien. The most northerly record is of one taken at Wanhsien, eastern Szechwan, by Dr. Walter Granger. Evidently this is a species of the warmer parts of China and should be looked for across the southern half of that country. A. B. Howell (1929) records three from Yochow, Hunan. Shih (1930, p. 3) mentions one (as *Scotophilus ornatus*) from a cave on a high cliff in the Yao Shan district, Kwangsi, and notes that it is in the Municipal Museum at Canton. Mell, writing from Canton (1922, p. 15), considers it not rare in the wooded mountainous region of northern Kwangtung, at from 600 to 1,000 meters altitude. By day, he says, it is often found in the branches of trees at a height of from 2 to 4 meters from the ground, a habit that might have been inferred from the coloration of the animal, so that Shih's specimen from a cave may have been in a somewhat unusual situation. Mell adds that these bats occasionally flew into his cabin in early evening, 7.30 to 9 P.M., apparently in pursuit of insects, and when captured uttered a shrill note like that of other bats. He gives a good colored figure of the species. Dobson (1876) mentions specimens from Nantin and Sanda valley, Yunnan, under *Scotophilus ornatus*.

Specimens examined:—In all, four, as follows:

Fukien: Chunganhsien, 1; Yenping, 2.
Szechwan: Wanhsien, 1.

Genus **Scotophilus** Leach

Scotophilus Leach, Trans. Linn. Soc. London, vol. 13, p. 69, 1821.
Pachyotus Gray, Zoological Miscellany, no. 1, p. 38, 1831 (part).

Externally the bats of this genus bear a close resemblance to *Eptesicus* in their olive and brown type of coloration in some species, the rather heavy body, and short, rounded ears. The tragus is somewhat crescent-shaped, the feet fairly large, with a low keel on the calcar, the tail extending to the edge of the interfemoral membrane. The skull, however, differs from that of *Eptesicus* in its tooth formula, having but one upper incisor on each side, namely: i.$\frac{1}{3}$ c.$\frac{1}{1}$ pm.$\frac{1}{2}$ m.$\frac{3}{3}$ = 30. The skull has the occiput prominently produced upward into a sort of helmet which slightly overhangs the posterior face of the cranium. It is rather stoutly built and has a well-developed sagittal crest. The chief distinguishing feature is the reduction of the mesostyles of the upper molars so that the W-pattern of the cusps is considerably altered,

the outer central peak of the W exceeded by the two other styles. In the lower molars the second triangle is noticeably smaller than the first.

Two species, a larger and a smaller, occur in the extreme southern parts of China, with, probably, subspecies on Hainan, while a third species, intermediate in size between these two, is also to be found, namely, *S. kuhlii*, the type species of the genus, or a closely allied subspecies.

KEY TO CHINESE SPECIES OF *Scotophilus*

A. Size larger, forearm about 65 mm., color dark olive brown..... *S. heathii insularis*
B. Size smaller.
  a. Forearm 58-62 mm., color olive brown above, yellowish below..... *S. kuhlii*
  b. Forearm about 50 mm., paler below, buffy..... *S. temminckii consobrinus*

124. **Scotophilus kuhlii** Leach

Scotophilus kuhlii Leach, Trans. Linn. Soc. London, vol. 13, p. 70, 1821.
?*Scotophilus heathii* Swinhoe, Proc. Zool. Soc. London, 1870, p. 619. Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 14, 1922.

Type specimen:—The type was a specimen in the collection of D. Brookes, described by Leach, but the locality was unknown. The description is extremely brief, but is evidently incorrect in stating that there are four upper incisors. The specimen later came to the British Museum, where it was studied by Dobson.

Description:—A large species, forearm about 58-62 mm. General color above, a rich olive brown to dark brown, the bases of the hairs buffy; below, a pale orange yellow, slightly more intense across the throat. Membranes dark.

Skull large and stoutly built, with the profile rising and the occiput slightly overhanging, with a strong median crest.

Measurements:—Two skulls measure as follows:

CRANIAL MEASUREMENTS OF *SCOTOPHILUS KUHLII*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
44544	23.7	18.7	10.6	15.9	13.8	9.9	7.5	8.8	Yunnan
83449	23.0	18.8	10.9	15.9	13.5	9.9	7.9	9.9	India

Occurrence and Habits:—This large bat is a common house-haunting species in parts of India, and is common throughout most of tropical and subtropical southeastern Asia. Within the limits of China, it occurs in southern Yunnan, whence the American Museum Asiatic Expeditions secured two at Homushu, Salween River. Eastward of this, however, I have no certain record, although it is to be looked for all along the southern subtropical border

to the coast. It is possible that Swinhoe (1870c) may have included this under one of the species he mentions from Canton. Perhaps, too, this is the bat recorded from the southwestern border of Hunan by Shih (1930b) as *Scotophilus emarginatus*.

Specimens examined:—Two from Homushu, Salween River, Yunnan.

125. Scotophilus heathii insularis J. A. Allen

Scotophilus kuhlii insularis J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 485, 1906.
Pachyotus kuhlii insularis A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 19, 1929.

Type specimen:—Adult male, skin and skull, No. 26786, American Museum of Natural History, from Rintoi, island of Hainan, China. Collected July 1, 1904.

Description:—Size large, forearm about 66 mm. Color above, uniform olive brown; below, pale brownish buff, darker on the sides.

Measurements:—In three adults the forearm measures 67, 64, 67 mm. respectively.

The available measurements of the skull of the type, as well as those of a complete skull from Nodoa, Hainan, are here given:

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
26786 (type)	—	—	—	——	—	—	8.6	10	Hainan
85242	26	21	7.5	17.8	15	11	8.7	10	Hainan

Occurrence and Habits:—The status of this bat in China cannot be cleared up without more material than at present seems available. Although described as a subspecies of *S. kuhlii* on the basis of greater size, it is nevertheless true that the measurements given appear to be those of the larger *S. heathii*, with which until recently *S. kuhlii* has been more or less confused by most writers. It, therefore, becomes a question whether after all the Hainan animal is really different from that of India. Assuming that it is, however, I have continued to use the name *insularis*, but as a subspecies of *S. heathii*. A. B. Howell (1929) records this race from Kachek, Hainan, as well as from Amoy, Fukien, on the basis of a specimen in alcohol from each locality in the U. S. National Museum. He writes of the latter that it is indistinguishable from the insular animal except for being somewhat paler.

Bats of this genus occur probably all across the southern border of China in the subtropical area, but specimens seem to be few in collections from the mainland, and the available records are indeterminate as to species. Thus Mell (1922, p. 14), under the name of *Scotophilus temminckii*, mentions finding a colony roosting among the leaf stalks of a fan palm (*Livingstonia*) at Szewui,

Kwangtung, while Shih (1930, p. 3) writes that it was first recorded from South China in 1824, and is abundant in Kwangtung, where he has observed large colonies in Kweilin; he also secured specimens from Kutchen and Loshiang in Kwangsi. It is not unlikely that these notes relate in part to *S. kuhlii*. Swinhoe (1870c, p. 619) records *S. heathii* as very common in Canton in April and May.

Specimens examined:—One each from Nodoa and Rintoi, Hainan.

126. **Scotophilus temminckii consobrinus** J. A. Allen

Scotophilus castaneus consobrinus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 485, 1906.
Nycticejus(?) swinhoei Blyth, Journ. Asiatic Soc. Bengal, vol. 29, p. 88, 1860.

Type specimen:—An adult female, skin and skull, No. 26788, American Museum of Natural History, from Rintoi, island of Hainan, China. Collected July 1, 1904.

Description:—Size smaller, forearm about 50 to 55 mm., a nearly uniform yellowish brown above, varying from slightly darker brown to paler yellowish brown; beneath much paler, nearly clear buffy on the sides and abdomen, and tinged with drab in the center of the breast.

In general size and in the characters of the skull this bat is hardly to be distinguished from typical *S. temminckii* of Java. The rostrum from above is somewhat pentagonal in outline, with the peak of the pentagon formed by two slightly defined ridges from the lachrymal region of each side to the interorbital region, where they fuse to form the sagittal crest. The latter is low but well marked, becoming higher at the occiput where it distinctly overhangs as a small casque-like projection.

Measurements:—In the type series the forearm in nine adults ranged from 50-52 mm., average 51. No other fresh measurements are available. The hind foot in well-made skins measures 11 mm.

CRANIAL MEASUREMENTS OF *SCOTOPHILUS TEMMINCKII CONSOBRINUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Occipital depth	Locality
58468	19.3	16.2	9.3	13.2	11.2	8.5	7.0	7.8	7.5	Hainan
58507	19.5	16.2	9.5	13.8	11.7	8.7	7.0	7.8	7.7	Hainan
58305	19.6	16.5	9.4	14.0	11.8	8.7	6.8	7.7	7.5	Hainan
58303	19.5	16.2	9.4	13.6	11.1	8.8	6.5	7.5	7.2	Hainan
58307	19.7	16.3	9.4	13.5	11.6	8.7	6.7	7.7	7.5	Hainan
58308	19.5	16.0	9.1	13.6	11.7	8.6	6.5	7.4	7.7	Hainan
58309	19.8	16.7	9.4	13.2	11.6	8.8	7.0	8.0	7.5	Hainan
58310	19.8	16.5	9.6	13.6	11.5	8.6	6.7	7.7	7.5	Hainan
58355	19.8	16.6	9.5	13.6	11.5	8.7	6.8	7.7	7.3	Hainan
58353	20.0	16.5	9.7	13.5	11.6	8.7	7.0	7.9	7.7	Hainan
Average	19.6	16.3	9.4	13.5	11.5	8.6	6.8	7.7	7.5	

Occurrence and Habits:—The type was one of seventeen specimens collected at Rintoi July 2; and in 1923, Mr. Clifford H. Pope also collected a series of 38 at Nodoa, Hainan. He writes that during the winter these were occasionally brought in by the Chinese. Although he failed to find any in various prospectors' holes examined, he once secured one lodged between the tiles and a supporting beam of the front porch. On April 18 a large number, estimated at about one hundred, were found among the dead hanging leaves of a palm tree in the mission compound; eighteen of them were shot and all proved to be females. Later, on June 9, this colony was found to have increased to large size and several hundred were killed. They had sought refuge under the drooping leaves of the palm. All of those examined proved to be adult females, most of them with young. Many of the latter were still hairless but others were already well covered. In the half-grown young the fur is short and darker than in adults. The milk teeth were all present, and the permanent dentition was beginning to appear. The two upper milk incisors are slender and long-rooted, the crowns with three practically equal divisions. The milk canine also has a trifid crown, but the two lateral cusps are smaller than the central one and lower, the innermost cusp less than the outer. In the milk premolars this reduction of the lateral cusps is carried still farther, so that they are almost wanting, but in one or two specimens the cusps are distinctly indicated by minute points.

Although described as a subspecies of *S. castaneus*, it seems most probable that the latter is but a form, perhaps distinct, of the older-named *S. temminckii* of Java, which is a much darker olive brown than the Hainan bat, and has a bright chestnut phase, which seems to be lacking in the latter. The skulls of the two are not certainly to be distinguished. I have, therefore, used the older specific name. The relationship with *S. wroughtoni* is undoubtedly close, but the skull is a trifle less delicate than in that animal, though the color is perhaps about the same. It should occur on the mainland of extreme southern China, but no records are available, although the Museum of Comparative Zoölogy has a skin from just across the border of French Indo-China, at Yenbey, Tongking, that is apparently identical with *S. wroughtoni*, and it is quite possible that Swinhoe's (1870c) record of *S. temminckii* at Canton in April and May, really refers to this. Perhaps, too, Blyth's *Nycticejus*(?) *swinhoei*, based on a specimen without "trace of upper incisors" sent him by Swinhoe, presumably from Amoy, is the same as this. The description is unidentifiable, and the type seems not to have been preserved.

Specimens examined:—In all, thirty-seven, from Nodoa, Hainan.

Genus **Barbastella** Gray

Barbastella Gray, London Medical Repository, vol. 15, p. 300, 1821.
Synotus Keyserling and Blasius, Arch. f. Naturgesch., vol. 5, pt. 1, p. 305, 1839.

Bats of this genus may be identified by their general dark color with lighter yellowish tips to the dorsal hairs, the extension of the fur out on to the interfemoral membrane to a line just below the head of the long tibia, and nearly as far beyond along the median portion of the membrane each side of the tail; in addition, the ears are rather short, not reaching the tip of the muzzle when laid forward, but distinctly joined across the forehead, and the nostrils open upward and outward behind a median pad. The brain case is relatively long, the rostrum slender and slightly concave medially; the zygomata are simple, without an expansion in the middle. The tooth formula shows a reduction of the premolars above and below to two on each side of each jaw, but otherwise the full number found in the less-reduced genera, as *Myotis*, is present. Miller points out that the lower canine has the cingulum produced into a noticeable anterior cusp; the anterior upper premolar is minute, crowded into the angle between the canine and large premolar, the latter without an interior cusp. The upper molars have a very large protocone but no hypocone. The third upper molar is fairly large with a crown area more than half that of the second or first. The relationships of the genus are regarded as with *Plecotus* and its American allies *Corynorhinus* and *Euderma*, but it represents a stage in which the ears and the audital bullæ are still small, the zygomatic arch simple, although in the reduction of the tooth row it is more progressive in the loss of two instead of only one of the premolars. The tooth formula is: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{2}{2}$ m.$\frac{3}{3}$ = 34. Two species are at present recognized, but it may prove that they are more closely related than supposed; for the ranges so far as known appear not to overlap, but rather to be continuous, the one (of *B. barbastellus*, the genotype) covering central Europe and the Mediterranean region, the other extending to eastern India and western China.

127. **Barbastella darjelingensis** (Hodgson)

Plecotus darjelingensis Hodgson, in Horsfield, Ann. Mag. Nat. Hist., ser. 2, vol. 16, p. 103, 1855.
Barbastellus dargelinensis Dobson, Proc. Asiatic Soc. Bengal, 1875, p. 85.
Synotus dargelinensis Dobson, Monograph Asiatic Chiroptera, p. 86, 1876.
Barbastella darjelingensis Thomas, Proc. Zool. Soc. London, 1911, p. 160.

Type specimen:—This bat was described from a specimen collected by Hodgson in Darjeeling, India, near the borders of Sikkim. It is presumably this specimen that furnished the basis of the brief description, by Dobson, in 1876, and if so, it is perhaps still in the Indian Museum at Calcutta.

Description:—A rather small bat, uniformly dark brown above and below from the bases of the hairs to near their tips, which are gray to buffy above

and whitish on the under side of the body. About the posterior end of the body below, the fur along the edge of the interfemoral membrane is whitish.

This is slightly different in some of the characters of the ear from the European species, *B. barbastellus*, with the ear slightly longer, so that when laid forward it extends about 2 or 3 mm. beyond the nose. The ear is broadly rounded off, not truncate, and with the tragus less attenuate above.

The characters of the teeth and skull have been mentioned under the genus. There is apparently very little if any important difference in the skulls of the two species.

Measurements:—Dobson (1876) gives the following measurements of a specimen from India (converted into metric units): head and body, 51 mm.; tail, 46; foot with claws, 8; ear, 19; tragus, 10; forearm, 41; second finger, 49.

CRANIAL MEASUREMENTS OF *BARBASTELLA DARJELINGENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
44562	14.3	12.0	5.7	7.5	7.7	5.7	4.6	5.2	Yunnan

Occurrence and Habits:—In China, as in India, this bat seems to be of uncommon occurrence, chiefly at the higher levels, and so far as known, in only the western parts of Yunnan, Szechwan, and Kansu. In Yunnan, the American Museum Asiatic Expeditions secured a single specimen at Likiang; and in the British Museum is a second from Weisi valley in the Yunnan highlands, taken by George Forrest. Still farther east, and north, Thomas (1911d, p. 160) records a single specimen secured at Omei Shan, Szechwan, and a second taken by W. N. Fergusson at Yinchinwan, in the same province. Finally, Buechner (1892) has mentioned a specimen secured by the Russian explorer, Berezovski, at Choihsien, in southern Kansu. It will be seen that these few records are all from the western highlands of China. To these may now be added that of an interesting specimen secured by the Brooke Dolan Expedition of 1931 at Shapai near Tsaopo, Szechwan, May 21, 1931, which lacks the minute anterior premolar in the upper jaw on both sides, so that the tooth formula is like that of *Eptesicus*. In other respects, however, and in the characteristic coloring, with yellowish-tipped hairs on the dark fur of the back, it is undoubtedly typical of this species. Its forearm is large, 44 mm., and the hind foot 9 mm. The absence of the hypocones of the upper molars is a noticeable feature of the species.

Specimens examined:—The following two:

Yunnan: Likiang, 1.

Szechwan: Shapai, near Tsaopo, 1 (M.C.Z.).

Genus **Plecotus** Geoffroy

Plecotus Geoffroy, Description de l'Egypte, vol. 2, p. 112, 1818.

This genus represents, in the development of its external ears, a considerable advance over *Barbastella*, for the conch is relatively enormous, considerably longer than the head, with a proportionally long tragus. The ears are joined by a fold of skin across the forehead. The nostrils are characteristic, opening upward, and with a posterior slit-like prolongation. The legs and feet are slender; the wing membrane arises from the base of the toes, and the tail, which is about as long as the head and body, is enclosed entirely in the membrane.

The tooth formula is less advanced in the process of reduction, retaining one more lower premolar on each side than in *Barbastella*, namely: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{2}{3}$ m.$\frac{3}{3}$ = 36. The upper incisors have each a small secondary cusp; the inner tooth is much smaller than the outer. The lower incisors form a convex row, the anterior the smallest, and increasing in size posteriorly, their crowns trifid. The lower canine has a small cingulum cusp at its anterior base. In the upper jaw, there is a slight space between the two premolars. The upper molars are short on the inner side, and lack the hypocone; the third molar is about half the crown area of the second, with a small but distinct metacone and third commissure. The skull has a rather large rounded brain case, with slender rostrum, and well-developed lachrymal ridges. The audital bullæ, in correlation with the size of the external ears, are unusually large (see Miller, 1907, p. 224). The type species is *Plecotus auritus* (Linnæus), and, although others have been named from central Asia, it is doubtful if any are at most more than subspecifically distinguishable. Three forms are recognized from China and Mongolia, but further collections may show that they are less distinct than supposed. They may be recognized by the following key:

Key to Chinese and Mongolian Forms of *Plecotus*

A. Size smaller, forearm 39-42 mm., pale gray below ..... *P. auritus auritus*
B. Size larger, forearm about 44-46 mm.
  a. Color as in typical race ..... *P. auritus kozlovi*
  b. Color darker, broccoli brown above, drab below ..... *P. auritus ariel*

128. **Plecotus auritus auritus** (Linnæus)

Vespertilio auritus Linnæus, Syst. Nat., ed. 10, vol. 1, p. 32, 1758.
Plecotus auritus auritus Bobrinski, Annuaire Mus. Zool. Acad. Sci. URSS, vol. 30, p. 240, 1929.

Type specimen:—Not known to be in existence; the type locality is assumed to be Sweden.

Description:—Form slender, ears very large, about as long as the forearm, rather oval in form, their bases joined across the forehead, a prominent rib

on the inner side, parallel with the border, and a triangular pointed lobe at the inner base. Tragus long, tapering rather abruptly at the end, and with a lobe at the outer base. Wing from base of outer toe; foot about half the length of tibia, its calcar not keeled.

General color above, nearly drab, slightly darkened by the scattered dull smoky tips of the hairs; at the base of the hairs everywhere, the proximal half or more is dark slaty. The lower side is gray with a buffy tinge, the basal part of the hairs everywhere broadly slaty. On the upper side there is a slightly tricolor effect produced by the slaty bases, the prominent drab subterminal band and the less obvious dark tips.

The skull is peculiar in its short narrow rostrum, the smooth rounded brain case, the large auditory bullæ, correlated with the large ears. The teeth are in general normal, the number of premolars, however, reduced to two above and three below on each side.

Measurements:—The external measurements of several specimens from northern Mongolia are published by Bobrinski (1929, table), as follows, and I have added for comparison those of a European example as given by Miller (1912, p. 260).

EXTERNAL MEASUREMENTS OF *PLECOTUS AURITUS*

No.	Forearm	Head and body	Tail	Foot	Ear	Tragus	Locality
(MILLER, 1912)	39.0	42	45	9.6	36.0	19.0	England
LENINGRAD							
8830	42.0	—	45	8.0	32.0	14.0	Mongolia
13929	42.5	—	49	—	34.0	15.0	Mongolia
13925	40.5	—	46	9.5	34.0	15.0	Mongolia
13926	43.5	—	44	9.0	34.0	16.0	Mongolia
13927	40.0	—	44	8.0	33.0	15.5	Mongolia
13928	41.0	—	49	9.5	34.0	16.0	Mongolia
14185	40.1	—	47	8.5	32.5	14.5	Mongolia
5186	40.0	—	—	8.5	31.2	15.0	Mongolia
5189	40.5	—	44	7.5	31.0	15.0	Mongolia
13930	41.0	—	48	9.0	32.0	15.0	Kansu
13931	39.0	—	43	8.0	33.0	16.0	Kansu

CRANIAL MEASUREMENTS (from Bobrinski, 1929)

No.	Greatest length	Condylo-basal length	Zygo-matic width	Width of brain case	Upper cheek teeth	Lower cheek teeth	Locality
13929	17.0	16.0	8.9	8.5	5.6	—	Mongolia
13925	17.3	16.0	9.0	8.0	5.6	—	Mongolia
13926	17.9	16.5	9.1	8.3	6.0	—	Mongolia
13931	16.5	15.5	9.0	7.9	5.5	—	Kansu

Occurrence and Habits:—The long-eared bat, in its typical form, appears to have a very wide range from the British Isles across northern Asia to the Pacific coast, passing chiefly northward of the Gobi. In Japan it appears to be very nearly the same, and, although I named the Japanese race *Plecotus sacrimontis*, on the basis of slight differences in size and proportions, it is quite possible that these will be found after all not very significant, so that Bobrinski (1929) is very likely right in believing the name a synonym of *P. auritus*. At all events, A. B. Howell (1929) regarded a series of nine specimens from Hopei, at Wutingshan, as quite the same as Japanese specimens. Jacobi (1922, p. 2) has also recorded the species from Hopei, on the basis of two secured by the Weigold Expedition at Peiping. Thence the species extends west along the northern edge of the Gobi in suitable localities. Radde as long ago as 1863 found it on the border of northern Mongolia; he secured a specimen on the east slopes of the Apple Ranges and another in July at a boundary post, Kiri (Kirmski), which he was unable to distinguish from the European form. More recently Bobrinski (1929) has added several records for the northern edge of Mongolia, namely: middle River Khuakem, Uriankhai, northwestern Mongolia, one; Suzukte, near Urga, five; Urga, one; Tintsa-intsa, east of Dolon Nor, south end of the Great Khingan Range, four; Tzinganshan, eastern Nanshan, Kansu, two. All these were taken in the months of June, July, August, and September. The specimens from eastern Nan Shan Range, across the border in Kansu, raise the presumption that the typical form may occur along the southern part of the Gobi, as it does along the northern part, but this is impossible to determine, because of the lack of specimens in localities eastward.

Specimens examined:—None.

129. **Plecotus auritus kozlovi** Bobrinski

Plecotus auritus kozlovi Bobrinski, Compt. Rend. Acad. Sci. URSS, 1926, ser. A, p. 98; Annuaire Mus. Zool. Acad. Sci. URSS, vol. 30, p. 243, 1929.

Plecotus auritus Buechner, Bull. Acad. Imp. Sci. St. Pétersbourg, vol. 34 (new ser., vol. 2), p. 106 (Mélanges Biol., vol. 13, p. 152), 1892.

Type specimen:—A male in alcohol, No. 5880, Zoölogical Museum of the Academy of Sciences, Leningrad, U. S. S. R., from Barun Zasak, eastern Tsaidam, Chinghai. Collected June 11, 1901, by Kozlov.

Description:—This bat appears to differ from the typical form in size only. The forearm averages larger, from 44.2-46.5 mm., in a series from the type locality, including eleven specimens. The color does not seem to be different.

The skull, as might be expected, is a little larger in its measurements

than those from northern Mongolia, according to Bobrinski's table, from which the following dimensions are reproduced.

Measurements:—The tail measurements seem a little longer and the ears a trifle greater than in northern specimens. The forearm is about a ninth longer.

EXTERNAL MEASUREMENTS OF *P. A. KOZLOVI*

No. LENINGRAD	Forearm	Tail	Foot	Ear	Tragus	Locality
5880 (type)	46.0	52	8.0	36.0	18.0	Chinghai
5879	46.0	52	8.0	36.0	19.5	Chinghai
5306	46.0	46	8.0	36.5	17.5	Chinghai
5307	44.2	48	7.5	37.5	19.0	Chinghai
5308	44.5	50	9.0	34.5	18.0	Chinghai
13932	46.0	48	9.0	38.5	18.5	Central Gobi
14186	43.0	48	7.0	34.0	16.5	Central Gobi
14187	44.0	50	9.0	35.0	19.0	Central Gobi

The cranial dimensions of some of the series examined by Bobrinski are given by him (1929) as follows:

CRANIAL MEASUREMENTS OF *PLECOTUS AURITUS KOZLOVI*

No. LENINGRAD	Greatest length	Condylo-basal length	Zygo-matic width	Width of brain case	Upper cheek teeth	Locality
5880 (type)	18.8	17.2	9.2	8.7	6.2	Chinghai
5879	18.8	17.6	9.8	9.1	6.5	Chinghai
5306	18.3	17.8	——	8.5	6.5	Chinghai
5311	17.8	16.7	9.3	8.7	6.0	Chinghai
5239	17.7	16.8	9.0	8.7	6.2	Chinghai
13932	19.0	18.5	10.2	8.5	6.2	Central Gobi
14186	17.6	16.8	9.5	8.0	6.5	Central Gobi
14187	18.4	17.2	9.5	8.5	6.1	Central Gobi

Occurrence and Habits:—Specimens of the Long-eared Bat from the desert regions of central Asia south and west of Mongolia seem to be decidedly larger than the typical subspecies from north of Mongolia. The forearm is about one-ninth longer and the skulls are proportionally a little bigger. It is difficult to know just how such specimens should be treated, but until more representative series can be examined from various surrounding parts, it may be that Bobrinski's course is the best, that is, to regard it as a slightly larger desert race, extending from the Koko Nor region eastward into the western part of the central Gobi. Bobrinski points out that the specimen recorded by Buechner from the valley of the Etsin River at Moming, southern Mongolia, may be this. Since all but one of the series examined by Bobrinski were in alcohol, a color comparison was not conclusive, but did not reveal any paler tint. The two Gobi localities recorded by this author are: Khara Khoto (skin, June 15,

1909, and June 6, 1926, alcoholic) and Ikhe Bogdo, Gobi Altai, south of Orok Nor. He doubts the validity of Thomas's *P. ariel*, though it is of about equal size.

Specimens examined:—None.

130. **Plecotus auritus ariel** Thomas

Plecotus ariel Thomas, Abstract Proc. Zool. Soc. London, February 14, 1911, p. 3; Proc. Zool. Soc. London, 1911, p. 160.
Plecotus areal Bobrinski, Annuaire Mus. Zool. Acad. Sci. URSS, vol. 30, p. 241, 1929.

Type specimen:—An adult female, skin and skull, No. 11.2.1.6, British Museum, from Tatsienlu, Szechwan, China, 8,400 feet altitude. Collected June 23, 1910.

Description:—Size large, general color dark, a "broccoli brown," the ends of the hairs dull drab. Under surface paler drab, the bases of the hairs dark slaty. Muzzle blackish.

"Skull large, with swollen brain-case and broad interorbital region. Bullæ large, only less than those of the Egyptian species" (Thomas).

Measurements:—Forearm, 44 mm.; head and body, 53; tail, 57; ear, 43; third finger, metacarpus, 39.5; first phalanx, 15.5; thumb, with claw and exclusive of metacarpal, 9.2; lower leg and hind foot with claw, 31.

Skull: greatest length, 17.2 mm.; basi-sinual length, 13.2; zygomatic width, 9; intertemporal constriction, 4; mastoid breadth, 9.4; front of canine to back of m^3, 5.6; greatest horizontal diameter of bullæ, 4.6.

Occurrence and Habits:—The species is based on the single specimen from Tatsienlu, Szechwan, but its describer believes that the dark coloration and somewhat larger size will suffice to distinguish it. A. B. Howell (1929) lists without comment a specimen in spirit from Sining, Kansu. Bobrinski (1929) considers that the presence of the small typical form in western Kansu makes the occurrence of a different species in Szechwan questionable; yet in the same paper he describes as new *Plecotus a. kozlovi* from the adjacent desert region, which seems to differ in much the same characters of slightly larger size and dark color from the former. For the present, the exact relationships of the named forms of eastern Asia must await the study of additional material. Thomas himself makes the comment that "of the genus *Plecotus*, *P. homochrous* (Nepal) and *puck* (Murree) (doubtfully distinct from each other) stand aside from the rest owing to their narrow brain-case; *auritus* (Europe) has rounder skull, small bullæ, and short thumbs; *christiei* (Egypt) large brain-case and very large bullæ; *wardi* (Ladak and Kashmir) large skull, rather large bullæ, long thumbs, and very pale color; *sacrimontis* (Japan) large skull, rather small

bullæ, and long thumbs; and finally the present species has large rounded skull, large bullæ, long thumbs, and dark color." It is perhaps best considered a race of *P. auritus*.

Specimens examined:—None.

Genus **Miniopterus** Bonaparte

Miniopterus Bonaparte, Iconogr. d. Fauna Ital., vol. 1, pt. 20, 1837.

The bats of this genus may be recognized at once by their rather short plush-like fur, low rounded ears, and by the very long second phalanx of the third finger, nearly three times the length of the first phalanx. It is made a distinct subfamily of the Vespertilionidæ by Miller (1907), who regards the "presternum with median lobe enormously developed and forming the greater part of the bone" and the straight and inwardly directed coracoid of the scapula as highly peculiar in the family, the latter character found again in the Molossidæ. The skull has a rather large globular brain case, with a short upturned rostrum, in the center of which is a conspicuous groove. In side view the fore part of the brain case is curiously swollen, causing a prominent elevation in profile, succeeded by a slight hollow, then rising again to the occiput. There is a low but distinct sagittal crest ending just back of the interorbital area. The palate is slightly concave, both from front to rear and from side to side. The small basisphenoid pits are confluent anteriorly. The tooth formula is: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{2}{3}$ m.$\frac{3}{3}$ = 36. The upper incisors are in two pairs with a space between the outer and the canine. The upper premolars are of unequal size, the anterior much smaller than the posterior but of similar pointed form. The last upper molar lacks the posterior commissure and the metastyle. Of the lower premolars the two anterior are of nearly equal height, but the second is broader; the third is high, slender in side view and nearly twice the height of the first.

This genus is widespread in the warmer parts of the Old World from the Mediterranean region and Africa to Australia. There is relatively little difference in color, which is usually some shade of smoky brown. The number of described forms, however, indicates considerable local variation, but the relationships of some of these are not in all cases clear. Within the limits of China, two types occur, a larger and a smaller. The type species of the genus is *M. schreibersii* (Kuhl) of Europe, a representative of the larger forms.

Key to Chinese Species of *Miniopterus*

A. Size larger, forearm about 47-50 mm.
   a. Lower side obviously paler than the back..... *M. schreibersii chinensis*
   b. Lower side not obviously paler than the back..... *M. schreibersii parvipes*
B. Size smaller, forearm about 40 mm..... *M. pusillus*

131. **Miniopterus schreibersii chinensis** Thomas

Miniopterus schreibersi chinensis Thomas, Proc. Zool. Soc. London, 1908, p. 638.

Type specimen:—A skin and skull, female, No. 8.8.7.15, British Museum, from a cave thirty miles west of Peiping, Hopei, China.

Description:—Color above, a uniform drab brown, almost smoky, without tinge of russet; below, similar, but the tips of the hairs are drab, especially under the throat and at the posterior part of the abdomen, which, therefore, seem considerably paler than the center of the chest. Compared with the European *M. schreibersii*, they are much darker, lacking the nearly uniform drab appearance of the western animal.

Measurements:—In size this bat is not very different from the European form, though if anything a very little larger. The forearm varies in length between 47 and 50 mm., against 44 to 46 in the latter. A male from Tunglu, Chekiang, was measured by J. T. Wright, the collector, as follows: total length, 122 mm.; tail, 56; hind foot, 14; ear, 13. Its forearm measures 49 mm.

Occurrence and Habits:—This dark smoky-colored subspecies is found apparently in no great numbers in North China. Thomas (1908f), in naming it, mentions that it was common in the cave whence the original series came, some thirty miles west of Peiping, Hopei, and was there associated with *Myotis pequinius*. Of the series of fifteen preserved, he adds that all but two were females. Two other specimens were secured by the American Museum Asiatic Expeditions at Wanpinghsien, in the same province. These localities may indicate in a general way its northward limit on the mainland, whence it ranges southward to the Yangtze valley. The most southern record I have is of a specimen in the Museum of Comparative Zoölogy, from Tunglu, Chekiang, not far from the mouth of that river.

Specimens examined:—Three, as follows:

Hopei: Wanpinghsien, 2.
Chekiang: Tunglu, 1 (M.C.Z.).

132. **Miniopterus schreibersii parvipes** G. M. Allen

Miniopterus schreibersi parvipes G. M. Allen, Amer. Mus. Novitates, no. 85, p. 7, August 28, 1923.
Miniopterus blepotis Swinhoe, Proc. Zool. Soc. London, 1870, p. 616.
Miniopterus schreibersi J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 485, 1906.
Pipistrellus blepotis Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 14, 1922.

Type specimen:—Adult male, skin and skull, No. 44656, American Museum of Natural History, from Yenping, Fukien, China. Collected June 16, 1916, by Dr. Roy C. Andrews.

Description:—Similar in size and proportions to *M. s. chinensis*, but the color is a uniform dark brown with a russet tinge, both above and below,

lacking the drab tint above, and the pronounced tipping of the fur of the lower side with the same. The usual color is uniform dark cinnamon brown above, nearly "Verona brown" of Ridgway, barely lighter below, about "snuff brown." The bases of the hairs on the upper side are not appreciably darker than the tips, but on the lower surfaces are slightly deeper brown. Males slightly darker than females, usually.

Measurements:—In the original description it is stated that the foot is smaller than in the North China race, but this does not seem to hold true of less-dried specimens. The following measurements are from the type skin: forearm, 48 mm.; third metacarpal, 43.5; first phalanx, 10.5; second phalanx, 39; fourth metacarpal, 42; first phalanx, 8.5; second phalanx, 14; fifth metacarpal, 39; tibia, 17; foot, 9.5. In five other skins from the same place the forearm varies between 47 and 48.8 mm., average 48; the hind foot varies from 8.7 to 9.8, average of five, 9.3.

CRANIAL MEASUREMENTS OF *MINIOPTERUS SCHREIBERSII PARVIPES*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
44656	16.0	15.5	8.0	8.7	8.5	6.5	—	—	Fukien
60218	16.0	14.0	8.0	9.0	9.0	7.0	7.6	8.0	Fukien
60219	16.2	14.0	8.0	9.0	9.0	7.0	7.5	7.8	Fukien
60220	16.2	14.2	8.2	9.0	9.0	7.0	7.7	8.0	Fukien
60221	15.7	13.7	7.8	8.7	8.7	6.8	7.3	7.8	Fukien
60222	16.6	14.0	8.0	9.2	9.0	6.8	7.8	7.6	Fukien
60223	16.0	13.6	8.0	8.8	9.0	7.0	7.6	8.0	Fukien
58483	16.5	14.3	8.5	9.8	9.6	7.5	8.0	8.5	Hainan
58394	17.2	14.7	8.7	9.8	9.6	7.5	8.3	8.7	Hainan
58460	16.4	14.4	8.2	9.5	9.2	7.3	8.0	8.5	Hainan
58411	17.0	14.6	8.8	9.8	9.7	7.6	8.5	8.8	Hainan
58513	17.1	14.8	8.6	9.8	9.2	7.4	8.1	8.6	Hainan
58472	16.6	14.3	8.5	9.5	9.1	7.8	8.3	8.7	Hainan
58442	16.7	14.3	8.3	9.2	8.9	7.4	8.0	8.2	Hainan
58484	17.2	14.9	8.7	9.8	9.5	7.7	8.4	8.8	Hainan
58481	16.7	14.5	8.6	9.5	9.2	7.4	8.1	8.6	Hainan
58424	16.7	14.5	8.5	9.9	9.5	7.6	8.1	8.6	Hainan
58490	16.9	14.6	8.4	9.1	9.2	7.3	8.1	8.7	Hainan
58322	16.6	14.4	8.4	—	9.0	7.4	8.0	8.5	Hainan
58450	16.4	14.1	8.1	9.3	9.0	7.2	8.0	8.3	Hainan

Occurrence and Habits:—This darker form of southern China is less pale below than that of northern China, with a more russet tone to the pelage. All the larger eastern bats of this genus are very similar in size and general coloration, so that it is difficult to know where to draw lines. It is not impossible that Temminck's name, *blepotis*, applied to the *Miniopterus* of Java,

may finally be used for the larger of the two continental species. Specimens from India, representing *M. fuliginosus*, are not very different from those of eastern China, but lack the warm russet tint to the otherwise somber pelage. I have, therefore, given the name *M. s. parvipes* to the latter, though it now appears that the supposedly smaller foot is hardly diagnostic.

This bat is common over the warmer part of at least southeastern China, from the Province of Fukien southward. A single specimen in alcohol, from Yochow, Hunan, is referred to this, and I am also including a series from the island of Hainan, which, although minutely larger in skull, seem otherwise quite the same. Swinhoe (1870c, p. 616) says that at Amoy, Fukien, they are common in summer, and are found with their young in caverns. Mell's (1922, p. 14) record of "*Pipistrellus blepotis*" from the Canton region also probably relates to the same animal, a specimen from Fongtjuen, Kwangtung.

The collections of the American Museum include specimens from Futsing and Yenping, Fukien, and a fine series from Hainan, as well as the specimen from Hunan above mentioned. A. B. Howell (1929) records additional specimens from Yenping in the U. S. National Museum. Mr. Clifford H. Pope, who collected the Hainan series, at Nodoa, writes that on December 19, he found a colony of hundreds of these bats "in a big hole under a pile of large boulders. They were clustered together for the most part in one place, hanging from the under surface of a large boulder which formed the ceiling. They made a continuous squeaking that was very audible from without. Later on another well-populated colony was found lodged between the tiles of the roof of a Chinese temple just west of Nodoa." From Hainan it had previously been recorded by J. A. Allen, as *M. schreibersi*. It is odd that Dr. Andrews and Mr. Heller did not meet with this bat in southern Yunnan, nor has anyone else apparently. Nevertheless it may occur in the warmer parts of that province along the Burmese border or eastward.

Among the skins from Yenping is one that is partially albinistic, having the entire chin and throat white as far as the base of the ears.

Specimens examined:—In all, seventy-two, as follows:
Fukien: Futsing, 3; Yenping, 11; Amoy, 1 (M.C.Z.).
Hunan: Yochow, 1 (in spirit).
Hainan: Nodoa, 56 (skins and spirit specimens).

133. **Miniopterus pusillus** Dobson

Miniopterus pusillus Dobson, Monograph Asiatic Chiroptera, p. 162, 1876. J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 485, 1906.

Type specimens:—In his original description, Dobson did not designate a type, but lists two specimens, one from the Nicobar Islands and one from Madras, which may, therefore, be regarded as the cotypes. Later, in the same

work (Dobson, 1876, p. 220), he lists specimens in the Indian Museum, of which there were two only, collected in the Nicobar Islands by Dr. Stoliczka, an alcoholic and a skeleton. Presumably, therefore, the Madras specimen is in the British Museum.

Description:—A smaller replica of the subspecies of *M. schreibersii*, from which it differs in the uniformly dark brown coloring, above and below, the hairs of the upper side not contrastingly different at the tips, while on the lower side, the fur of the abdomen is faintly darker at the extreme base. There is none of the russet tinge in the three specimens examined, and the males do not seem to differ from females in size or coloring.

Measurements:—The smaller size of this species is evidenced by the shorter forearm, which is nearly 10 mm. less than that of the larger species which occurs with it in Hainan. Three skins show the following dimensions:

No.	Forearm	Tibia	Foot
58330	41.5	16.6	7.0
58360	40.4	16.6	7.6
58413	41.2	15.5	7.5
(cotype)	40.0	15.0	7.5

CRANIAL MEASUREMENTS OF *MINIOPTERUS PUSILLUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth row	Lower tooth row	Locality
58330	14.0	11.8	6.4	7.6	8.0	5.6	6.5	6.6	Hainan
58360	13.5	11.4	6.3	7.5	7.8	5.6	6.3	6.6	Hainan
58413	13.8	11.7	6.4	7.5	7.7	5.6	6.2	6.5	Hainan

Occurrence and Habits:—In the warmer parts of India and southeastern Asia, as well as upon certain of the islands as far east as Australia, two species of this genus occur together, a larger and a smaller. The larger is of the *M. schreibersii* style; the smaller is typified by *M. pusillus*, originally described from the Nicobars and from Madras. Wroughton has regarded the small Indian species as identical with the latter, and J. A. Allen has referred to it also thirteen specimens from Rintoi, island of Hainan. Three others collected by Mr. Clifford H. Pope at Nodoa, on the same island, and in the same cave apparently as that in which he took the large series of *M. s. parvipes*, represent also this smaller species. It has not been taken in China northward of this point, and may, therefore, have in general a more southerly range, subtropical. It should be looked for at points on the mainland in extreme southern China. Otherwise its habits are not known to differ essentially from those of its larger relative.

Specimens examined:—Three, from Nodoa, Hainan.

Genus **Kerivoula** Gray

Kerivoula Gray, Ann. Mag. Nat. Hist., ser. 1, vol. 10, p. 258, 1842.

The only genus of the subfamily Kerivoulinæ known to occur in China is *Kerivoula* itself, represented by two species of wide distribution in southeastern Asia and the East Indies. Miller has distinguished the subfamily by its very short sternum, with which four or five ribs only articulate. The tooth formula is the same as that of *Myotis*, namely: i.$\frac{2}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{3}{3}$ = 38. The teeth, however, are less reduced than in that genus, the three lower premolars especially, all of nearly the same size, the anterior two in the upper jaw likewise large, fully in the tooth row, and subequal. There are no hypocones on the upper molars. The skull is slender and delicate, resembling slightly that of a *Myotis*, with smooth rounded brain case, lacking prominent sagittal or lambdoid ridges. Externally the members of this genus are recognizable by their delicate, funnel-shaped ears and long tragus, as well as by the dense, fine and almost woolly-appearing fur.

The type species was fixed by Sclater as *K. hardwickii* (Horsfield) of Java.

Key to the Chinese Species of *Kerivoula*

A. Color orange and black, forearm about 39 mm..... *K. picta bellissima*
B. Color dull smoky brown, forearm about 34 mm..... *K. hardwickii depressa*

134. **Kerivoula picta bellissima** Thomas

Kerivoula picta bellissima Thomas, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 423, 1906. Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 14, 1922.

Type specimen:—A skin and skull, No. 6.1.13.1, British Museum, from Pakhoi, southern Kwangtung, China. Collected by Dr. Hayley Bell.

Description:—Similar to the typical form from Java, but slightly larger and the fur longer. Fur dense and somewhat crinkly, pale at the extreme base, the distal half a beautiful orange-rufous, this color extending to the entire ears, the entire interfemoral membrane, hind feet and legs above and below, and out on to the wing membranes as far as a line just forward of the ankle to a few millimeters out from the posterior border of the forearm, and in a narrow stripe the length of each finger. The interspaces of the wing between the third and fourth, the fourth and fifth fingers, and between the fifth finger and posterior edge of forearm to ankle, excluding the free edge of the wing membrane, contrastingly black. On the lower side, the fur is whitish at the base, becoming delicate russet at the tips. The toes as well as the entire edge of the interfemoral membrane are fringed with minute short hairs.

Measurements:—The type specimen had a forearm of 39 mm., and was said to have but six caudal vertebræ, but the single specimen from Hainan

has distinctly seven. In this specimen the fur is about 9.0 mm. long, against 7.0 in a Javanese example. The greater size is also shown in a comparison of the metacarpal lengths in these two (the first measurement is in each case from No. 54940, A.M.N.H., from Hainan, those in parenthesis of a Javanese specimen of *K. picta picta*): third metacarpal, 37.5 mm. (31); fourth metacarpal, 36.5 (31); fifth metacarpal, 36 (30).

The length of the skull of the type was 15 mm.; length of palate in midline, 7; upper tooth row from front of incisor to back of last molar, 7.5. No other cranial measurements are at present available.

Occurrence and Habits:—This very beautiful little bat, with its strongly contrasting orange body and black-marked wings, is singularly like *Myotis formosus rufo-niger* in its style of coloring, but is considerably smaller in size. It is apparently uncommon, and confined to the warmer parts of extreme southern China, for at present there are but two instances of its presence known: that of the type from Pakhoi, southern Kwangtung, and a second, consisting only of the skin mounted on celluloid, secured by the Central Asiatic Expeditions in Hainan. As might have been guessed from its peculiar coloring, this species is said to spend the day hanging among leaves, its pattern simulating somewhat the tints of withered foliage.

Specimens examined:—One only, a skin from Hainan.

135. **Kerivoula hardwickii depressa** Miller

Kerivoula depressa Miller, Proc. Biol. Soc. Washington, vol. 19, p. 64, May 1, 1906.
Kerivoula hardwickii Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 4, 1930.

Type specimen:—Adult female in alcohol, skull dry, No. 18533/38194, U. S. National Museum, from Biapo, Carin Hills, northeast of Tounghoo, southern Burma. Collected by L. Fea.

Description:—Fur of the back almost uniformly smoky brown, about mummy brown (Ridgway), except on the forehead where the hairs are pale at the base, minutely tipped with brown. Below, the fur is everywhere dark fuscous at base, tipped with buffy gray. There seems to be little of the tricolor effect mentioned in the case of the typical race and the type specimen.

The skull, though practically of the same size as that of *K. hardwickii* of Java, has a much less globular brain case. It is instead obviously flattened.

Measurements:—The following measurements are from the dried skins.

No.	Forearm	Third metacarpal	First phalanx	Fourth metacarpal	Fifth metacarpal	Tibia	Foot
84832	34.5	36.7	15	35	33.8	15	7
84833	33.0	——	—	—	——	—	—

The skulls of these two specimens seem a trifle larger than that of the type from Burma, as recorded by its describer.

CRANIAL MEASUREMENTS OF *KERIVOULA HARDWICKII DEPRESSA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
84832	14.7	12.0	7.7	8.7	7.5	5.5	5.6	6.0	Fukien
84833	15.0	12.3	7.8	8.5	7.7	5.6	5.8	6.3	Fukien

Occurrence and Habits:—Three skins from Chunganhsien, Fukien, seem best referred to this continental race of the Javan *K. hardwickii*, notwithstanding the slight discrepancies in size and color, which may be individual. Apparently they are slightly darker, with more extensive sooty bases to the hairs, thus almost or quite obliterating the tricolor pattern of the hairs. The cranium is more flattened than that of the Javan form.

The extension of this species into Chinese territory was one of the discoveries of the American Museum Asiatic Expeditions. In addition to three specimens (in spirit) from Yenping, Fukien, three skins were secured in 1926 by Mr. Clifford H. Pope, at Chunganhsien, in the northwestern corner of the same province. Since then, a specimen from Yao Shan, Kwangsi, has been recorded by Shih (1930, p. 4) and one by Sanborn (1933, p. 56) from Yangchashan, southeastern Szechwan. It may be looked for anywhere in the extreme south of China, probably favoring the subtropical areas. Its small size, long tragus, and tooth formula might at first cause it to be mistaken for a *Myotis*, but the rather short, funnel-shaped ears are distinctive, as well as the dense fur and more particularly the characters of the dentition with three lower premolars of nearly equal size, and the two anterior upper ones relatively large and subequal.

Specimens examined:—In all, six, as follows:
Fukien: Chunganhsien, 3; Yenping, 3 (in alcohol).

Genus **Murina** Gray

Murina Gray, Ann. Mag. Nat. Hist., ser. 1, vol. 10, p. 258, 1842.
Ocypetes Lesson, Nouv. Tableau Règne Anim., Mamm., p. 30, 1842 (part; preoccupied by *Ocypetes* Wagler, 1832).

The extraordinary tubular nostrils distinguish the members of this genus from any other Chinese bats, while the essentially normal molars further suffice to separate it from the genus *Harpiocephalus*, of the same subfamily, Murininæ, the occurrence of which in subtropical China may be looked for, since it is found close to the border in Tongking. Otherwise the two genera show no special external features to distinguish them from *Myotis*. The skull is similarly delicate and slender as in the medium-sized species of that genus. The teeth indicate, however, a curious specialization over the condition in *Myotis*, in that there is one less premolar in each jaw, giving the formula: $i.\frac{2}{3}$ $c.\frac{1}{1}$ $pm.\frac{2}{2}$ $m.\frac{3}{3} = 34$. The upper incisors have no secondary cusps, and the

outer of each pair is larger than the inner. The anterior upper premolar is unusually large, and stands fully in the tooth row filling the space between the canine and the posterior premolar. The first and second upper molars are nearly square in section, and lack the hypocone. On their outer edge the parastyle is somewhat reduced, which distorts the regular W-pattern. The third upper molar is fairly large. The type species is *Vespertilio* (=*Murina*) *suillus* Temminck, of Java.

At present four species are recorded from the southern part of China, but it is not impossible that the relationships of the two larger species may be closer than now suspected.

KEY TO CHINESE SPECIES OF *Murina*

A. Forearm less than 35 mm.
   a. Color above, golden yellow, forearm 28 mm..... *M. aurata*
   b. Color above bright ferruginous, forearm 33 mm..... *M. cyclotis*

B. Forearm more than 35 mm.
   a. Forearm about 38 mm., color rufous brown above..... *M. huttoni rubella*
   b. Forearm about 41 mm., color similar..... *M. leucogaster*

136. **Murina aurata** Milne-Edwards

Murina aurata Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 250, pl. 37B, fig. 1; pl. 37C, fig. 2, 1868-74 (1872).
Harpiocephalus auratus Dobson, Monograph Asiatic Chiroptera, p. 153, 1876.
Murina aurita Miller, Bull. U. S. Nat. Mus., no. 57, p. 230, 1907 (*lapsus*).

Type specimen:—The type is presumably still at the Muséum d'Histoire Naturelle at Paris, having been sent by Père Armand David, probably in 1871, from the principality of Muping, Szechwan, China.

Description:—Size small, forearm 28 mm. Tubular nostrils long, well detached from the muzzle, directed outward and slightly forward, and separated from the upper lip by an enlarged lobe. Ears short, broadly rounded at their tips, their posterior border unnotched. Wing membrane from the base of the toes. Interfemoral membrane with scattered hairs.

Fur above, blackish at base, then golden yellow at the extremities; upper surface of forearm with short yellowish hair; below, the fur is blackish at the base, the tips grayish white.

The canine has a well-marked cingulum; first upper premolar is much smaller than second, which about equals canine; three lower incisors small, subequal, and with three-lobed crowns; lower canine hardly exceeding the first premolar in height.

Measurements:—The following dimensions of the type specimen are given by Milne-Edwards: total length, 62 mm.; tail from anus, 29; hind foot, 7.0; ear, 10; forearm, 28; spread of wings, 190; tibia, 14. The forearm of a second specimen measured 29 mm. (A. B. Howell, 1929, p. 20).

Occurrence and Habits:—This small species seems to be rare and has been discovered in China but twice since Père David sent back the original specimen from Muping, in central Szechwan. The second Chinese record is afforded by a specimen from the Likiang Range, Yunnan, in the U. S. National Museum, mentioned by A. B. Howell (1929), while a third is in the Field Museum, taken in Szechwan. Nothing is known of its habits. Its very small size and coloration should be distinctive.

Specimens examined:—None.

137. **Murina cyclotis** Dobson

Murina cyclotis Dobson, Proc. Asiatic Soc. Bengal, 1872, p. 210; Journ. Asiatic Soc. Bengal, vol. 42, pt. 2, p. 206, pl. 14, 1873.
Harpiocephalus cyclotis Dobson, Monograph Asiatic Chiroptera, p. 158, 1876.
Murinus cyclotis J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 487, 1906.

Type specimen:—The type is said by Dobson to be an alcoholic female, No. 692 in the collection of the Indian Museum at Calcutta. It was from an unknown locality, doubtless from somewhere in eastern India.

Description:—Size small, forearm 33 mm. Nostrils tubular, diverging; ears nearly circular, about as wide as long, with a slight convexity opposite the tragus on the outer side; tragus tapering to a fine point; wing membrane attached along the outer edge of the foot to the base of the claws; extreme tip of tail free. Upper surface of interfemoral membrane hairy, especially at the root of tail, along the tibiæ, and on the calcanea; backs of the feet thickly covered with hair which projects beyond the toes.

Color above bright ferruginous, the hairs everywhere with dark-brown bases; beneath paler brown throughout.

Upper incisors long and slender, the outer shorter than the inner; first and second premolars of upper jaw subequal, and about half the height of the canine; last lower molar smaller than the one in front of it.

Measurements:—Dobson (1876, p. 160) gives the following dimensions for an Indian specimen (reduced to metric units): head and body, 43.5 mm.; tail, 38; foot with claws, 7.8; ear, 15; forearm, 33; tibia, 15. Forearm of the Hainan specimen mentioned below, 33 mm.

Occurrence and Habits:—The only basis for the inclusion of this species in the Chinese fauna is the record by J. A. Allen (1906, p. 487) of a female from Youboi, island of Hainan, taken June 21, 1904, and now in the American Museum of Natural History. He writes: "This specimen agrees satisfactorily in nearly all particulars with Dobson's description and figures of *M. cyclotis* from Darjiling, in the Himalaya. The fur, however, is not very distinctly bicolor, the bright rufous extending nearly the whole length of the hair on the dorsal surface, only the extreme base showing a darker, brownish shade;

below a lighter, more brownish yellow to the base of the fur . . . there is a close agreement in dentition, size, color, the hairiness of the interfemoral membrane and feet, etc., notwithstanding the great geographical separation of the two localities."

Specimens examined:—None.

138. **Murina leucogaster** Milne-Edwards

Murina leucogaster Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 252, pl. 37A, fig. 2; pl. 37C, fig. 3, 1868-74.
Murina leucogastra Thomas, Proc. Zool. Soc. London, 1898, p. 771.

Type specimen:—The type was sent, presumably in alcohol, to the Muséum d'Histoire Naturelle at Paris by Père Armand David, who collected it in the Muping district, Szechwan, China, in October (1873).

Description:—A small tube-nosed bat, forearm 41 mm. Ears narrow, shorter than the head, wing membrane from the tarsus. Feet and interfemoral membrane hairy above. Pelage long and fine, in color chestnut brown above, the hairs everywhere slaty gray at their bases. Throat, chest and abdomen white, shading into brown at the sides.

Measurements:—The type measured as follows (Milne-Edwards, 1868-74, p. 253): total length, 88 mm.; tail from anus to tip, 34; hind foot, 11; ear, 14; forearm, 41; tibia, 17. No cranial measurements are available.

Occurrence and Habits:—Except for the original specimen from the principality of Muping that served Milne-Edwards as the type of this species, only one other seems to have been taken in China, namely, one recorded by Thomas (1898, p. 771) from Kuatun, northwestern Fukien. Dobson, however, has recorded it from the northwestern Himalayas.

Specimens examined:—None.

139. **Murina huttoni rubella** Thomas

Murina huttoni rubella Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 13, p. 440, 1914.

Type specimen:—An adult male, skin and skull, No. 8.8.11.6, British Museum, from Kuatun, northwestern Fukien, China. Collected September 21, 1896, by F. W. Styan.

Description:—Resembling the Indian *M. huttoni*, but more rufous. Color above dark rufous brown, rather warmer than "sayal brown" of Ridgway, the longer hairs glossy golden brown. Under surface rather paler than the upper at the sides and still paler down the middle area but without strong contrasts.

Measurements:—The forearm of the type measured 37.5 mm. Skull, greatest length, 18.2 mm.; basi-sinual length, 13.7; upper cheek teeth, front of canine to back of last molar, 6.2.

Occurrence and Habits:—Thomas, to whom we are indebted for all that is known of this bat, states that it is readily distinguished from the typical race of India by its darker, more rufous tint than the grayer animal to the west. Seven specimens in all were collected by Messrs. F. W. Styan and J. D. La Touche at Kuatun, Fukien, and presented by them to the British Museum, in 1896. Dobson assigned *M. huttoni* to the synonymy of *M. leucogaster*, but, as Thomas (1914a) states, the latter is larger with a forearm of 41 mm., skull 20 mm. in greatest length; nevertheless the two are perhaps only subspecifically related. The species must be wide-ranging, for Sowerby has described a race, *M. h. fuscus*, from Manchuria.

Specimens examined:—None.

Family MOLOSSIDÆ

MASTIFF BATS

The bats of this family may be recognized by their peculiar plush-like fur, the thickened interfemoral membrane from which the terminal half or thereabouts of the tail projects, the short, strong hind legs, the very narrow wing in which the fifth finger is hardly longer than the metacarpal of the third, and by the peculiar short ears with a decidedly angular tip, and thickened inner edge which is extended as a ridge projecting from the inner border. The tragus is usually very small, squarish or narrow. Miller (1907, p. 242) emphasizes the following additional family characters: humerus with the outer supplementary head much larger than the inner; ulna less reduced than in the Vespertilionidæ, its very slender shaft about half the length of the radius; first phalanx of third finger, when at rest, folded on the upper side of the metacarpal; seventh neck vertebra fused with the first dorsal; fibula complete; lumbar vertebrae not fused together; skull lacking postorbital processes.

The molossid bats are characteristic of the tropics and subtropics of both the Old and the New Worlds. Many of them take readily to living under the roofs of houses between the ceiling and the roofing, often causing much annoyance by their musky odor and the deposit of droppings. Two genera only occur in China, and probably in only the extreme southern part under usual conditions. These may be identified by the following key:

KEY TO GENERA OF CHINESE MOLOSSIDÆ

A. The palate without a conspicuous median notch..... *Chærephon*
B. A conspicuous notch present at the front of the palate..... *Nyctinomus*

Genus **Chærephon** Dobson

Chærephon Dobson, Journ. Asiatic Soc. Bengal, vol. 43, pt. 2, p. 144, 1874 (as a subgenus of *Nyctinomus*). Andersen, Ann. Mus. Civ. Storia Nat., Genova, ser. 3, vol. 3, p. 35, 1907 (as a genus).

The wrinkle-lipped bats of this genus closely resemble in external characters the members of the genus *Tadarida* (*Nyctinomus*), but are distinguished

by the skull, in which the premaxillary bones are complete on the palatal side, so that there is no deep notch extending back of the upper incisors, such as is present in that genus. Usually the two premaxillaries are intimately fused with the surrounding bones, leaving two small foramina at the end of the palate, or a very small notch in front of the incisors. Externally, the half-free tail, narrow wings, short tibiæ, and lips with vertical wrinkles will distinguish the genus from all except *Tadarida* and *Nyctinomus*. The tooth formula is the same in both *Chærephon* and *Nyctinomus*, namely: i.$\frac{1}{2}$ c.$\frac{1}{1}$ pm.$\frac{2}{2}$ m.$\frac{3}{3}$ = 30. The genus is one of tropical and subtropical distribution in the Old World only, and barely reaches southern China. The genotype is *Nyctinomus* (= *Chærephon*) *johorensis* Dobson, of the Malay Peninsula. Only the following species is as yet known from China.

140. **Chærephon plicatus** (Buchanan-Hamilton)

Vespertilio plicatus Buchanan-Hamilton, Trans. Linn. Soc. London, vol. 5, p. 261, pl. 13, 1800.
Nyctinomus plicatus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 482, 1906.
Chærephon plicatus Miller, Bull. U. S. Nat. Mus., no. 57, p. 245, 1907.

Type specimen:—A male, from Puttahaut, Bengal. The specimen has apparently been lost sight of.

Description:—Size medium, forearm about 50 mm., ears joined at their bases across the forehead, lips with conspicuous vertical wrinkles. General color above, a rich dark brown; below, the bases of the hairs are dark brown, their tips minutely paler; but in the middle region of the throat, chest and abdomen they are broadly tipped with whitish.

In the skull, the muzzle is slightly depressed in side view, and there is a conspicuous convexity of the outline just behind the level of the orbits. A low but well-marked sagittal ridge extends forward from the strong lambdoid crests to the interorbital constriction. The crowns of the upper incisors are vertical, and almost in contact medially. At the anterior corner of the orbit is a prominent bony knob.

Measurements:—The forearms in five specimens from Hainan range from 49.7–50.4 mm.

The cranial measurements follow:

CRANIAL MEASUREMENTS OF *CHÆREPHON PLICATUS*

No.	Length, vertex to front of incisors	Palatal length	Zygomatic width	Width outside molars	Upper tooth row	Lower tooth row	Lower jaw	Locality
26687	——	——	——	9.5	9.7	9.0	14.5	Hainan
26688	——	8.6	——	9.6	9.6	8.8	13.8	Hainan
26689	20.5	——	11.8	9.4	9.0	8.9	14.5	Hainan
26690	21.7	8.7	12.6	9.2	9.4	8.6	14.4	Hainan
26691	21.6	8.8	12.1	9.5	9.6	9.0	14.6	Hainan

Occurrence and Habits:—This is a widely distributed species in the eastern tropics from India to the East Indies. The only record of its occurrence within the boundaries of China seems to be that of Dr. J. A. Allen (1906), who had five adult males from Rintoi, island of Hainan, taken July 1, 1904. These I have examined. No doubt the species will eventually be found at other points along the extreme southern border of China.

Specimens examined:—Five, from Rintoi, Hainan.

Genus **Nyctinomus** E. Geoffroy

WRINKLE-LIPPED BATS

Nyctinomus E. Geoffroy, Description de l'Egypte, vol. 2, p. 114, 1818. Thomas and Hinton, Proc. Zool. Soc. London, 1923, p. 251.

The genus *Nyctinomus* is now regarded as valid, and distinct from *Tadarida* of the New World in that there are only four instead of six lower incisors. The type species of the genus is *Nyctinomus ægyptiacus* E. Geoffroy, a large-eared bat of northern Africa. A closely related species is found in southern China.

141. **Nyctinomus teniotis insignis** Blyth

Nyctinomus insignis Blyth, Journ. Asiatic Soc. Bengal, vol. 30, p. 90, 1861; Cat. Mamm. Asiatic Soc. Bengal, p. 29, 1863.
Dysopes (Molossus) rueppelli Swinhoe, Proc. Zool. Soc. London, 1870, p. 619.
Nyctinomus cestonii Dobson, Monograph Asiatic Chiroptera, pp. 179 (head of type of *N. insignis* figured), 180 (part), 202-203 (type listed), 1876.
Nyctinomus tæniotis Trouessart, Cat. Mamm. Viv. Foss., p. 145, 1897 (in part; "ad Chinam").
Tadarida latouchei Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 5, p. 283, 1920.

Type specimen:—The type, a male in alcohol, is listed by Dobson (1876) as in the collection of the Indian Museum, Calcutta, No. 180. It was sent to Edward Blyth, then Curator, from Amoy, Fukien, China, by Consul Robert Swinhoe in 1860.

Description:—Size large, forearm about 60 mm., ears large, broadly rounded off in front, and with their anterior bases meeting in the middle of the forehead by a wide inward extension, which is densely covered with short hair. Lips ample, with some seven vertical grooves between the angle of the mouth and the nostrils. The latter open at the outer corners of a truncate pad, the upper rim of which is studded with minute horny projections. Wings from the ankles, tail with its terminal half projecting. Borders of the feet with a fringe of stiff projecting hairs, which are long on the outer border, and short on the inner. Fur soft, fine and dense, extending ventrally a short distance out on the wing membrane at the sides.

Above, nearly clove brown, the hairs whitish at the base, their extreme tips minutely frosted with grayish; below, nearly similar brown, the hair of

the throat uniformly colored, that of the chest and belly with longer light tips than that of the back.

Measurements:—The following measurements of the type (reduced to millimeters) are given by Blyth (1861): total length, 140 mm.; tail, 47; forearm, 64; third finger, 114. Dobson's (1876) measurements of the same specimen, however, are a little different: forearm, 58.2 mm.; head and body, 82.5; tail, 53; foot and claws, 10; ear, 29.5 x 21.5; tibia, 16.6. These are very similar to those of the type of *T. latouchei* as given by Thomas, namely: head and body, 76 mm.; tail, 43; ear, 23; forearm, 56.5; third metacarpal, 53; first phalanx, 20.5.

The skull of the immature specimen that served as type of *T. latouchei* measured: greatest length, 21.7 mm.; condylobasal length, 21.2; zygomatic width, 12.2; mastoid width, 12; palato-sinual length, 7.1; upper cheek teeth, 8. Doubtless the skull of a fully adult individual would show slightly greater dimensions.

Occurrence and Habits:—This large free-tailed bat seems to be uncommon in the extreme south of China. The first record of its presence is based on the specimen secured by Consul Robert Swinhoe at Amoy, Fukien. It was sent with other specimens of mammals and birds to the Asiatic Society of Bengal, in 1860, and was made the type of *Nyctinomus insignis* by Blyth. His description seems to have been long overlooked, however, although Dobson in 1876 made mention of the specimen and figured its head as that of *Nyctinomus cestonii.* Swinhoe (1870c) in his list of South China mammals again mentions the specimen, under *Dysopes rueppelli*, and states that it was brought in to him alive on November 25, 1859. The only other records for eastern China are of one presented by J. D. La Touche to the British Museum that was captured at sea in the Formosa channel; and a second, an immature male, taken September 9, 1917, by the same collector, at Chinwangtao, on the seacoast of northeastern Hopei. This specimen, as remarked by Thomas (1920), is by far the most northerly ever taken in Asia, and perhaps this fact led him to describe it as *Tadarida latouchei*, despite its immaturity. But it seems so far out of the normal range of the species, and its very slightly smaller size is so probably due to its youth, that there can be hardly any doubt of its representing the same form of South China, and must have been either carried north by a ship or blown by a storm, for no others have ever been found within a thousand miles of Hopei (although Ognev includes Vladivostok in its range). In extreme southwestern Yunnan, a single specimen taken in 1922 has been described by Thomas as a distinct race, differing in slightly darker color, but it may eventually prove to be not very different. Without having seen specimens, however, I can only add Thomas's account of it.

Specimens examined:—None.

142. **Nyctinomus teniotis cœcata** (Thomas)

Tadarida teniotis cœcata Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 392, 1922.

Type specimen:—A skin and skull, No. 22.9.1.2, British Museum, from the Mekong valley, Yunnan, China, in about 28° 20′ north latitude, at an altitude of 7,000 feet. Collected by George Forrest.

Description:—Color above, "quite similar" to that of *T. teniotis* of Europe and the Mediterranean region, but much darker, a dark mummy brown above.

Measurements:—Thomas (1922b) gives the following measurements of the type: head and body, 89 mm.; tail, 55; forearm, 60.

Total length of skull, 24.8.

Occurrence and Habits:—There is but the single record for this race, namely, that of the type specimen taken in the Mekong valley, about 28° 20′ north, in northwestern Yunnan, by George Forrest. The species seems to be in general rather solitary in habits, and nowhere common. The brief description given indicates its darker color than the European form, which it otherwise resembles, even to the forearm measurement. The latter is possibly slightly larger than in the race *N. t. insignis* of eastern China, so that, although the distinction seems at present somewhat doubtful, it may for the present be regarded as a valid subspecies.

Specimens examined:—None.

CHAPTER VI

ORDER PRIMATES

LEMURS AND MONKEYS

THE lemurs, monkeys, and apes undoubtedly are an arboreal offshoot of some ancient insectivore group. They have retained many generalized characters of body and skeleton, such as the nearly equal development of the limbs, the full five fingers and toes in most species, the independence of radius and ulna, and of tibia and fibula, with the freely rotating forearm. As an arboreal adaptation they have an opposable thumb, the fingers usually with flattened nails; the tail is usually long in the more agile species, serving as a balancer, but in some of the baboons, which are partly ground-livers, and in some of the slow-moving lemurs, the tail is much reduced. In the skull the orbit faces more or less forward, and in the lemurs it is enclosed by a bony ring, while in the more typical monkeys the eye is completely shut off from the temporal fossa by a wall of bone, formed in part by an extension of the frontal and jugal bones. The lemurs are now regarded as forming a suborder, Lemuroidea, distinguished by many anatomical peculiarities from the Anthropoidea, which includes monkeys, the great apes, and man. Most obvious of the external characters of the lemurs are the widely opposable thumbs and great toes, the clawed second toe of the hind foot and in some the reduction of the second digit of the hand to a mere stump. In the skull the lachrymalfo ramen is without the edge of the orbit in the lemurs, just within it in the Anthropoidea. The teeth of the lemurs depart less from the primitive insectivorous type than in most of the Anthropoidea, for the upper molars usually show the primitive W-pattern of cusps fairly well marked. The incisors, however, are very different, those of the upper jaw with a tendency to reduction, and the development of a space between the two pairs of opposite sides, while in the lower jaw they are proclivous, projecting forward as sharp-pointed and compressed teeth, in close contact with each other, and with the lower canines, which have become like them in form and function, so that their places are taken by the first lower premolars. The brain of the lemurs is less highly specialized in size and convolutions of the cerebrum, indicating their lower

intelligence. The lemurs are at present confined to Africa and the forests of southeastern Asia, with one species only apparently occurring on the very most southern border of China. Of the Anthropoidea, or typical monkeys, the Gibbon is found in Yunnan and Hainan; two species of small macaques and one of the stump-tail group are also found in southern China, while one genus, the large and handsome langur-like *Rhinopithecus*, is practically confined to the mountains of southwestern China.

KEY TO THE GENERA OF CHINESE PRIMATES

A. Hands with the index finger reduced to a stump, the second hind toe with a claw (Lemuroidea) ..... *Nycticebus*

B. Hands and feet with digits normally developed, and provided with flat nails (Anthropoidea).

a. Tail considerably longer than hind foot.

a′. Tail exceeding head and body.

a″. Nose flat ..... *Pithecus*

b″. Nose produced as a fleshy, upturned rim ..... *Rhinopithecus*

b′. Tail less than length of head and body ..... *Macaca*

b. Tail less than length of hind foot or wanting.

a′. Fore and hind limbs of about equal length ..... *Lyssodes*

b′. Fore limbs much exceeding hind; tailless ..... *Hylobates*

Family LORISIDÆ

SLOW LEMURS AND GALAGOS

This family comprises the so-called Slow Lemurs, represented in African forests by the Pottos (*Perodicticus* and *Arctocebus*) and in the southeastern part of Asia by the Lorises. They are tailless or nearly so, slow of movement, and with slender limbs. Two genera are found in tropical Asia, *Loris* and *Nycticebus*, of which the latter apparently just crosses the Chinese border in extreme southwestern Yunnan and probably in the eastern provinces.

Genus **Nycticebus** E. Geoffroy

Nycticebus E. Geoffroy, Ann. Mus. d'Hist. Nat., Paris, vol. 19, p. 162, 1812.

The Slow Loris is distinguished generically from its relative the Slender Loris by its stouter, shorter limbs, and by the characters of the skull, in which the anterior edge of the premaxillaries barely projects beyond the incisors, instead of being distinctly extended; the molar row of the upper jaw extends back of the level of the posterior nares; the inner pair of upper incisors is much larger than the outer, which are mere spicules and sometimes lacking. The first upper and first lower premolars are longer than those succeeding them, the former separated from the canine by a distinct space, the latter caniniform, closing behind the true canine. The upper molars have the paracone and metacone on the outer edge well developed, but rather blunt, the protocone larger,

with a small hypocone behind it. The tooth formula is: i.$\frac{2}{2}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{3}{3}$ = 36. The type species is *N. coucang* (Boddaert) of Bengal.

One species seems to reach the tropical edge of China.

143. **Nycticebus coucang cinereus** Milne-Edwards

Nycticebus cinereus Milne-Edwards, Ann. Mus. d'Hist. Nat., Paris, vol. 7, p. 161, 1867. Anderson, Anat. and Zool. Researches Western Yunnan, p. 103, 1879.
Nycticebus tardigradus var. *cinerea* J. Anderson, Cat. Mammals Indian Mus., Calcutta, pt. 1, p. 96, 1881.

Type specimen:—The type specimen is a mounted skin in the Muséum d'Histoire Naturelle at Paris, so faded from exposure to light that "there is not much more than a trace of the original coloring left" (Elliot). It came from "Siam."

Description:—Anderson describes a specimen from the borders of western Yunnan as having the eyes surrounded by brown, while below the brown area a white band passes from the ear, joining the central white area of the face above and below. Elsewhere the general color is a clear gray with a reddish tinge on the sides of the body, the shoulders, and outer side of the limbs. There is a median dorsal line of dark reddish chestnut extending from the center of the head to the rump. Ears rufous; under parts grayish white.

Measurements:—The measurements of a specimen in the British Museum are given by Elliot (1913) as follows: total length of skin, about 370 mm. Skull: occipito-nasal length, 61 mm.; basilar length, 53; palatal length, 21; zygomatic width, 43; width of brain case, 30; upper molar series, 18; length of mandible, 39; lower molar series, 15. Anderson's Bhamo specimen measured: muzzle to vent, 13.2 inches (336 mm.); tail, 0.75 inches (19 mm.).

Occurrence and Habits:—Undoubtedly this species reaches the Chinese border in extreme southwestern Yunnan, for Anderson (1879) states that it is found in the Kakhyen Hills to the east of Bhamo, which would be on the border. He briefly remarks on a specimen he secured there. The only other record seems to be that of Swinhoe (1870c, p. 615), who bought a living one in the Canton Market in 1863, that was said to have come from the Province of Kwangsi, in the southwestern part, a statement which, in view of the animal's occurrence in the Kakhyen Hills, seems extremely probable. Mell (1922, p.11), who resided for several years in Canton, writes that he can add nothing to Swinhoe's record.

Specimens examined:—None.

Family CERCOPITHECIDÆ

BABOONS AND GUENONS

This family contains the macaques, baboons, and guenon monkeys of the Old World, and usually the langurs are included with them, but their

anatomical structure is somewhat different, correlated with their leaf-feeding habits, so that they are either regarded as a subfamily or given family rank. I have followed the latter course. The macaques and baboons agree in having the tail usually somewhat shortened, although in their African relatives, the guenons and mangabeys, this member is longer, for these are tree-livers chiefly, while the former are partly terrestrial in habits. The baboons have the facial portion of the skull elongated, the canines long and powerful in the males. The thumb is fairly well developed, the stomach not sacculated.

Two genera, *Macaca* and *Lyssodes*, the former including the Rhesus Monkey, the latter the Stump-tailed Macaque, occur in Chinese territory.

KEY TO GENERA OF CHINESE CERCOPITHECIDÆ

A. Tail moderately long, exceeding hind foot ..... *Macaca*
B. Tail a mere stump, shorter than hind foot ..... *Lyssodes*

Genus **Macaca** Lacépède

Macaca Lacépède, Tableau des Mammifères, p. 4, 1799; Nouv. Tabl. Meth., Mamm., in Mém. de l'Inst. Paris, vol. 3, p. 490, 1801.
Macacus Desmarest, Mammalogie, vol. 1, p. 63, 1820.
Pithecus Geoffroy and Cuvier, Mag. Encyclopédique, vol. 3, p. 462, 1795 (part). Elliot, Review of the Primates, vol. 2, p. 176, 1913.
Rhesus Lesson, Revue Zool., 1840, pp. 49, 95.

These are rather heavy-bodied monkeys, with short, stout limbs, and variable tails, usually less than the length of head and body, but sometimes reduced to a mere stump. The nostrils open slit-like and downward. There is a pair of conspicuous callosities on the buttocks. These monkeys have cheek pouches in which food may be temporarily stored. The eyebrow ridges in the skull are very heavy, giving the face a beetling brow; the canines in the males are long, sharp, and strong with a groove on the outer face. The first and second lower molars show four cusps each in two transverse rows, while the third lower molar has a fifth posterior cusp. The tooth formula, as characteristic of the family, is: i.$\frac{2}{2}$ c.$\frac{1}{1}$ pm.$\frac{2}{2}$ m.$\frac{3}{3}$ = 32. The genotype is the Barbary Ape (*Simia* [= *Macaca*] *inuus* Linnæus).

Two species of this genus are here recognized as occurring in China, one the widespread and familiar Rhesus Monkey, the other an allied species found in western Yunnan and the adjacent parts of Burma.

KEY TO THE CHINESE SPECIES OF *Macaca*

A. General hue of pelage orange or yellowish above ..... *M. mulatta*
B. Pelage nearly uniform brown above ..... *M. assamensis*

144. **Macaca assamensis** (McClelland)

Macacus assamensis McClelland, Proc. Zool. Soc. London, 1839, p. 148. Anderson, Anat. and Zool. Researches Western Yunnan, p. 64, 1879.
Macacus (*Pithex*) *pelops* Hodgson, Journ. Asiatic Soc. Bengal, vol. 9, p. 1213, 1840.

Macacus problematicus Gray, Cat. Monkeys Brit. Mus., p. 128, 1870.
Macacus rhesus, var., Anderson, Anat. and Zool. Researches Western Yunnan, p. 57, pl. 3, 1879.
Pithecus assamensis Elliot, Review of the Primates, vol. 2, p. 209, 1913 (with synonymy). Anderson, Proc. Zool. Soc. London, 1872, p. 529, fig.
Macaca assamensis Hinton and Wroughton, Journ. Bombay Nat. Hist. Soc., vol. 27, p. 669, 1921 (with synonymy).

Type specimen:—The type specimen is said by Anderson, who examined it, to have been in the "Indian Museum" at London. It was an adult male, mounted, and lacked the skull. According to Elliot (1913), it is not to be found in the British Museum, to which the types in the Museum of the Honourable East-India Company were supposed to have been transferred. The type locality is Assam, probably in the Garo Hills region.

Description:—Similar in general size and proportions to the Rhesus Monkey, but of a uniform brown with a slight yellowish tinge above.

The fur above is a nearly uniform olive or faintly yellowish brown from the head to tip of tail, including the forearms and the hind limbs all around. On the cheeks and bordering the forehead, the long hairs are black-tipped. Rest of lower surface pale gray or drab. There is a "cowlick" in the center of the crown, from which the hair radiates in all directions, that with a forward slope meeting the black-tipped hairs of the forehead in a slight ridge.

According to Hinton and Wroughton (1921) this species is slightly more heavy of build than the Rhesus, and may weigh up to 28 pounds.

Measurements:—The above authors give 575 mm. as the maximum length of head and body, or very slightly more than for the Rhesus.

Cranial characters differentiating these two are summarized by Hinton and Wroughton as follows: skull larger and more massive, brain case relatively shorter and narrower; occipital crest and temporal ridges strongly developed, the latter in adults fusing to form a strong sagittal crest, whereas this is never the case in the Rhesus; supraorbital ridges noticeably more thickened; mandible relatively longer and narrower between the condyles and tooth rows. The canines are much larger, those of the upper jaw deeply grooved anteriorly, while the cheek teeth are relatively weaker.

CRANIAL MEASUREMENTS OF *MACACA ASSAMENSIS*

No.	Greatest length	Condylobasal length	Palatal length	Orbit to end of premaxillary	Zygomatic width	Mastoid width	Width across orbits	Width outside molars	Width of brain case	Upper cheek teeth, c—m^3	Lower cheek teeth, c—m_3	Locality
43083	122.0	92.5	47.0	39	76	66	63.0	39.0	61	42.5	49	Yunnan
43088	112.5	83.5	42.5	35	71	62	59.5	36.5	62	——	—	Yunnan

Of the two available Chinese specimens whose skull measurements are given in the table above, the first is an adult female, the second a subadult of the same sex, whose last molars are not yet erupted. The worn milk premolars are still in place and a very small milk canine; the second molar, however, is unusually large and well in place. Old males may be considerably larger. Of measurements given by Hinton and Wroughton for a large male from Sikkim, the following are sufficient to indicate this: occipito-basilar length, 140.3 mm.; zygomatic width, 92; cranial width, 62.7; orbital width, 72.8; upper cheek teeth, 42.7.

In the skull the posterior border of the frontal is evenly convex backward in the Rhesus but in *M. assamensis* is much more narrowed, U- or V-shaped.

Occurrence and Habits:—This monkey seems to have a somewhat restricted range from the Sunderbuns of India to the Naga Hills, Sikkim and Nepal at the higher elevations, eastward to the borders of Yunnan. Anderson (1879) reported its presence on the western frontier of Yunnan below Bhamo, Burma, on the Irrawaddy. Here lived a large colony below a huge limestone cliff and persons passing in boats threw them rice and fruits. The total length of a female secured here was 26.75 inches (680 mm.); tail, 9.25 inches (235 mm.). The first definite record of it for China is based on the three specimens secured by Dr. R. C. Andrews on the Namting River, not far from the Burma border, on March 3, 4, 1917. It may readily be told from the Rhesus, which it somewhat resembles, by the uniform brown of the upper surface, lacking the bright orange and ochery tints.

Specimens examined:—Three, from Namting River, southwestern Yunnan.

145. **Macaca mulatta** (Zimmermann)

RHESUS MONKEY

Cercopithecus mulatta Zimmermann, Geogr. Geschichte Menschen u. vierfüss. Thiere, vol. 2, p. 195, 1780.

Simia rhesus Audebert, Hist. Nat. des Singes et Makis, family 2, p. 5, 1789.

Simia erythræa Shaw, Gen. Zoology, vol. 1, p. 33, 1800.

Inuus sancti-johannis Swinhoe, Proc. Zool. Soc. London, 1866, p. 556.

Macacus lasiotus Gray, Proc. Zool. Soc. London, 1868, p. 60, pl. 6. Sclater, Proc. Zool. Soc. London, 1871, p. 221.

Macacus tcheliensis Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 227, pls. 32, 33, 1868-74 (1870).

Macacus erythræus Swinhoe, Proc. Zool. Soc. London, 1870, p. 226.

Macacus sancti-johannis Swinhoe, *ibid.*, p. 615. Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 10, 1922.

Macacus lasiotis Anderson, Anat. and Zool. Researches Western Yunnan, p. 85, 1879 (synonymy; type skull figured).

Macacus rhesus Trouessart, Cat. Mamm. Viv. Foss., p. 27, 1897. Thomas, Proc. Zool. Soc. London, 1898, p. 770. J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 488, 1906; *ibid.*, vol. 26, p. 242, 1909.

Macacus lasiotis tcheliensis Trouessart, Cat. Mamm. Viv. Foss., p. 27, 1897.

Pithecus littoralis Elliot, Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 250, 1909; Review of the Primates, vol. 2, p. 201, 1913.

Pithecus brachyurus Elliot, Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 251, 1909 (not of H. Smith). Hainan.

Pithecus sancti-johannis Elliot, Review of the Primates, vol. 2, p. 198, 1913.

Pithecus lasiotis Elliot, *loc. cit.*

Pithecus brevicaudus Elliot, *ibid.*, p. 216, pl. 23 (in place of *P. brachyurus*, preoccupied).

Macaca mulatta Hinton and Wroughton, Journ. Bombay Nat. Hist. Soc., vol. 27, p. 668, 1921.

Macacus brevicaudus Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 11, 1922.

Type specimen:—The name is based on Pennant's description (not his figure) of a Tawny Monkey in a Mr. Brook's menagerie, seen presumably at London, about 1770. The specimen was doubtless never preserved.

Description:—A medium-sized macaque with tail less than the head and body length. The general color above is tawny, becoming brighter fulvous over the lower back and upper parts of the hind limbs. About the shoulders the hair is longest, 70 mm., or more, ashy gray at the basal half or so, this color showing through and giving a grayish tinge to the shoulders. The hairs of the upper side usually show very narrow annulations of ochraceous and black. The sides of the face and a narrow band across the forehead are sparsely clothed with black hairs. Feet and lower parts of the limbs drab gray, with a slight ochraceous wash. Lower surface pale grayish white. Tail about half the body length, colored at the base like the back, buffy gray below.

The skull is somewhat less massive than that of *M. assamensis*, the facial portion relatively short. The temporal ridges do not, even in adults, join to form a sagittal crest, and the supraorbital ridges are less prominent, so that the central part of the frontal area bulges upward as seen in profile, in a somewhat characteristic way. The posterior border of the frontal is usually evenly convex backward, forming nearly a semicircle.

Measurements:—No fresh measurements of Chinese specimens are at hand. Hinton and Wroughton (1921), however, give the following for a large male: head and body, 540-560; tail, 225-250. For a nearly adult female, Milne-Edwards gives the total length, following the curves of the back, as 580 mm., of which the tail is 150; hind foot, 145 (type of his *Macacus tcheliensis*). A still younger female collected by W. R. Zappey at Nagchuka, Szechwan, measured: total length, 515 mm.; tail, 156; hind foot, 125. A large male from Kuatun measured: total length, 810 mm.; tail, imperfect, 200.

Mr. Clifford H. Pope says that according to the Chinese of Hainan, this monkey may weigh when full grown as much as twenty pounds, while an even larger figure, up to 23 or 24 pounds, is given by Hinton and Wroughton, hence not so large as the maximum for *M. assamensis*.

CRANIAL MEASUREMENTS OF *MACACA MULATTA*

No.	Greatest length without incisors	Condylobasal length	Palatal length	Orbit to gnathion	Zygomatic width	Mastoid width	Width across orbits	Width outside m^2	Upper cheek teeth	Lower cheek teeth	Sex	Locality
19991 MCZ	118.0	95.0	47.3	38.0	82.6	69.0	67.5	39.0	43.5	47.0	♂	Kwangtung
57039	125.0	99.0	50.4	44.0	82.6	68.0	68.3	38.0	40.0	43.0	♂	?
60083	106.5	85.0	43.0	34.0	74.5	61.5	60.0	35.3	40.0	42.3	♂	Hainan
59986	102.0	77.0	38.0	32.5	70.0	60.5	61.0	34.5	——	——	♀	Hainan
60038	104.5	82.4	41.0	35.5	70.0	62.0	59.0	36.0	35.0	37.5	♀	Hainan
59987	102.0	87.2	39.0	33.0	69.0	60.5	58.0	33.6	36.2	39.5	♀	Hainan
43085	112.0	87.0	44.5	38.0	73.0	61.0	56.0	36.0	40.3	43.0	♀	Yunnan
43086	103.0	82.0	38.0	30.6	70.5	58.5	57.0	32.5	36.1	39.0	♀?	Yunnan
57111	121.5	91.0	48.0	45.5	74.6	66.0	63.2	39.5	40.0	44.4	♀	?

Occurrence and Habits:—This monkey is at once recognized by its gray and golden to orange-rufous dorsal coloring, combined with the comparatively short tail. Hinton and Wroughton (1921) have shown that the specific name *rhesus*, so long in familiar use for this monkey of India and southeastern Asia, is antedated by Zimmermann's *mulatta*, which must, therefore, be taken as the valid name, based on Pennant's account of the tawny monkey of India. In addition to various synonyms, applied mainly to specimens from India, several have also been bestowed upon Chinese individuals, all of which seem, however, to represent essentially the same animal. Among the first of these is Gray's *Macacus lasiotus*, founded on an animal said to have come from Szechwan, and sent to the Zoological Society at London. It lived in the Society's Gardens for some time, and after its death it was found that the extremely short tail, which was the chief character distinguishing it, was due to the fact that this member had been amputated at some early period. This is a common practice among the Chinese when they keep captive monkeys, for it is said that the tail is considered to bear a resemblance to their own long braid of hair, and such a mockery is displeasing. Swinhoe (1866) had shortly before described as *Inuus sancti-johannis* a very young individual, supposed to have been about four months old, that was taken by Commander St. John of H.M.S. "Opossum" on the little island of North Lena, near Hongkong. It had been captured alive and sent later to the Zoological Gardens at London. Sclater (1871) doubted its distinctness, and in this was unquestionably correct, for the South China Rhesus seems quite the same throughout its range in that country. Nevertheless, Milne-Edwards (1868-74 [1870]) named as a

new species, *Macacus tcheliensis*, a Rhesus Monkey sent from the region of the Eastern Tombs, Hopei, to the Paris Museum. Elliot, who apparently examined the type in that institution, states (1913, vol. 2, p. 200) that it is undoubtedly the same as *M. lasiotus*, a conclusion with which, after comparing specimens from both Szechwan and the Eastern Tombs, I can heartily agree. Later, Elliot named specimens from Kuatun, Fukien, *Pithecus littoralis*, on the avowed ground that, notwithstanding the resemblance in coloring to "*P. lasiotis*," "the great distance intervening between the habitats . . . does not permit the supposition that they are of the same species." They are nevertheless, so far as material at hand shows, quite the same with due allowance for individual variation. Elliot also described as a distinct species, the Rhesus occurring on Hainan, which had been in the same year identified by J. A. Allen with the Indian Rhesus. Elliot gave it the name *Pithecus brachyurus*, later changing this to *P. brevicaudus* on account of the previous use of the former name for another species. After an examination of a series from this island, however, I fail to see any really distinctive characters, although Pocock (1932) admits this with others as valid forms.

The range of the Rhesus Monkey, therefore, extends from India and Nepal, eastward to the Pacific, including all of South China from the Yangtze valley southward. Its presence in Hopei, in the vicinity of the Eastern Tombs, seems to be anomalous, as the locality is far north of the general range, and the winters are often severe, with the thermometer going below zero Fahrenheit at times. I feel sure that this colony is the result of introduction by man at some time in the past, for the Chinese emperors were wont to bring various animals to their hunting preserves and turn them loose. This suggestion was first made by Möllendorff (1876), though he himself doubted its correctness. He adds that tame ones are often brought to Peiping from Szechwan. It is true that the colony seems to flourish in spite of the latitude. As long ago as 1880, Dr. S. W. Bushell sent a pair from this locality to the London Zoological Gardens, and again in 1886 a second pair (see P. L. Sclater in Proc. Zool. Soc. London, 1886, p. 417). On leaving China in 1900, Dr. Bushell sent a third pair, and Sclater remarks (*ibid.*, 1900, p. 181) that at that time the male of the pair sent in 1880 was still alive and in good health, after twenty years. Pocock (Proc. Zool. Soc. London, 1906, p. 567) has recorded the case of one that lived in captivity for twenty-eight years. No doubt, as Dr. Bushell remarked, the long thick fur fits the monkey to endure the cold of North China, but its coat does not appear to be really thicker than that of southern specimens at a comparable season. Indeed, Milne-Edwards himself was later inclined to regard his *M. tcheliensis* as the same as *M. lasiotus*. Six specimens from the Eastern Tombs were secured by the American Museum Asiatic Expeditions.

Excepting, then, the Hopei colony, as due to a successful introduction,

the natural range of the Rhesus Monkey in China seems to extend from the latitude of the Yangtze valley southward. I have no records for the lower part of the valley, but a large dark-gray monkey briefly seen by Steward (1925) in the Hwang Shan of south-central Anhwei was probably this. It occurs at Fukien, as at Kuatun (type locality of Elliot's *P. littoralis*). A. B. Howell (1929) has recorded three specimens from Shanghai, Kiangsu, but it is likely that they were not wild-killed specimens in such a populous district, as he himself implies. Pope secured specimens in northwestern Fukien, at Chunganhsien, where, he writes, this monkey is very difficult to approach. "Old hunters say that about two score years ago before the acquisition of foreign guns, the monkeys were so abundant and bold that they frequently ravaged crops, having become accustomed to the old slow-firing muzzle-loaders then in use." This monkey is found at many places in southern and central Szechwan. Thus Weigold secured a male and an immature female at Wanhsien (Jacobi, 1922, p. 1) and he writes that they are said to occur in Wassuland and at Maochow, upper Min valley, in the north of the same province. Howell mentions specimens in the U. S. National Museum from Mount Omei, Giakeoho, and Suifu in central Szechwan, and Zappey secured it at Nagchuka, at 10,000 feet altitude (G. M. Allen, 1912, p. 245). A "Simia sp." from the mountains thirty miles southwest of Kiatingfu, recorded by Thomas (1912e, p. 128), may have been the same. South of these localities, this monkey occurs more commonly, especially in rocky places or on cliffs along streams. It seems distinctly a rock-haunting species, as various authors have noticed. Swinhoe speaks of it as present on most of the small islands in the bay of Hongkong, mentioning specifically North Lena Island. It is said to occur also on Lofau Heights near Canton (800-1,000 meters) where small bands are often seen among the stranded logs along the river shore (Mell, 1922, p. 11). They are often brought to the market at Canton, as no doubt elsewhere, to be sold as pets. Swinhoe (1870c) mentions its use in medicine. The Chinese split the dried body, and the skeleton is used also in the drug stores. He adds that, according to the Chinese Gazetteer, the Chinese work "She-show" (or Notes on Animals) states that this monkey has no stomach but digests its food by jumping about! On the island of Hainan, it is well known to be common. Mr. Clifford H. Pope found it in numbers in the forest west and south of Nodoa, where large troops were said to be frequently seen. Here they live in high trees and are difficult to secure by shooting, although the Chinese catch many alive to be sold as pets, or else for manufacture into "monkey paste," which is made of the entire animal, and eaten as a tonic. In some places in the island he was shown where they had pulled vines and destroyed potatoes in the gardens. Doubtless the Rhesus Monkey will be found all along the southern provinces of China, but precise records

are lacking. In Yunnan the American Museum Asiatic Expeditions secured specimens from Tengyueh and the Namting River along the southwest border, and A. B. Howell (1929) notes specimens in the U. S. National Museum from Ashi. Very likely this is the monkey referred to by Du Halde (1738) as found in Kwangsi, "a kind of Apes, with yellow Hair, which by their Shape, and Shrilness of their Yell, have a great Resemblance of Dogs"!

There possibly should be added to the list of synonyms *Macacus vestitus* of Milne-Edwards, a long-haired Rhesus-like monkey, described from Tengri Nor, Tibet, but said to occur eastward to Batang in extreme western Szechwan (now Hsikang).

Specimens examined:—In all, thirty-three, as follows:

Hopei: Eastern Tombs, 6.
Fukien: Chunganhsien, 2.
Kwangsi: (?), 1.
Hainan: Nodoa, 5; Namfong, 2.
Yunnan: Namting River, 1; Tengyueh, 3.
"South China," 5.
No definite locality, 7.
Szechwan: Nagchuka, 1 (M.C.Z.).

Genus **Lyssodes** Gistel

Lyssodes Gistel, Naturgesch. Thierreichs f. höhere Schulen, p. ix, 1848. Pocock, Ann. Mag. Nat. Hist., ser. 9, vol. 7, p. 229, 1921.
Macacus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 244, 1868-74 (in part).
Pithecus Elliot, Review of the Primates, vol. 2, p. 176, 1913.

Although the Stump-tailed Macaques have usually been placed in the same genus as the Rhesus Monkey, the Crab-eating Macaque, and others, they seem distinct enough by their very short tail, limbs of about equal length, and especially by the characters of the penis, which, as Pocock (1921) has pointed out, is structurally very different from that of the other macaques. This was first noted by Anderson (Proc. Zool. Soc. London, 1872, p. 203) and further insisted upon by Pocock on the basis of his own work. In *Lyssodes* the glans penis is very long and tapering instead of short, rounded and subovate as in *Macaca*. Moreover, it is strengthened by a baculum or penis bone of slightly sigmoid shape, which in Pocock's specimen of *L. speciosus* was 42 mm. long. In *Lyssodes* the urethral opening is in the median line on the ventral side, beneath the apex of the baculum, whereas in *Macaca* it is a vertical terminal slit, slightly eccentric, to the right of the apex of the short baculum.

The type species of the genus is *Macacus* (=*Lyssodes*) *speciosus*, which was described by Cuvier on the basis of a drawing made by Duvaucel. It is not known, however, whence the latter's specimen came. Several subspecies have been described, the status of which is quite doubtful, though two are here considered as valid. The Japanese Macaque is a closely related species.

146. **Lyssodes speciosus thibetanus** (Milne-Edwards)

Macacus thibetanus Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 70, p. 341, 1870.
Macacus tibetanus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 244, pls. 34, 35, 1868-74.
Macacus brunneus Anderson, Proc. Zool. Soc. London, 1871, p. 628; *ibid.*, 1872, p. 203, pl. 12; *ibid.*, 1874, p. 652.
Macacus arctoides Anderson, Anat. and Zool. Researches Western Yunnan, p. 45, pls. 1, 2, 1879 (in part).
Macacus arctoides tibetanus Trouessart, Cat. Mamm. Viv. Foss., p. 27, 1897.
Pithecus thibetanum Elliot, Review of the Primates, vol. 2, p. 196, pl. 21, 1913.

Type specimen:—The type specimen is still in the Muséum d'Histoire Naturelle at Paris, to which it was sent by the collector, Père Armand David, from the district of Muping, central Szechwan, China.

Description:—A large brown monkey with very short tail. The coloration is described by Elliot from the type in the Paris Museum, as follows: "top of head and nape pale brown; face, whiskers, inner sides of limbs and under parts whitish gray; upper parts and sides of body, arms, hands, thighs and feet, blackish brown tinged with chestnut; legs from knees to ankles whitish gray, tinged with brown." The face may be bright red, but in other individuals is more flesh-colored. The hair of the shoulders is long, up to 90 mm. and in adults shows a minutely annulated appearance, especially over the fore part of the body.

A. B. Howell (1929, p. 34) describes a male from Mount Omei, Szechwan, as "almost black above, smoky brown below, and there is much gray grizzling about the face." A female from the same locality is browner and lacks the grizzling.

Measurements:—Milne-Edwards records the length of the head and body in the type (adult male) as about 800 mm. following the curves of the back; Elliot gives its tail measurement as 99.06 mm., but no doubt the .06 must have been added inadvertently! In the original account the tail is said to be 100 mm. including the hair. The female is smaller, about 600 mm. from muzzle to end of tail; the tail, hardly 60 mm.

The type and the female described by Milne-Edwards gave the following measurements of skull:

CRANIAL MEASUREMENTS OF *LYSSODES S. THIBETANUS*

	Male	Female
Greatest length	164 mm.	140 mm.
Palatal length	74	57
Occipito-incisive length	121	98
Zygomatic width	107	94
Width outside orbits	79	71
Width across canines	33	33
Upper molar series	39	39
Lower molar series	50	47

Occurrence and Habits:—It may be doubted whether the Stump-tailed Macaque of western China is really very different from the typical form of the species, which unfortunately cannot be assigned a definite type locality, since the specimen from which Cuvier's figure was made was in a menagerie at Barrackpore, India, fifteen miles from Calcutta. Anderson (1879, p. 50) suggested that the animal may have come originally from somewhere in Assam or Cachar, for during the time he was in Calcutta, three or four others had come into the Calcutta market, and all from the districts mentioned. The range of the species in general extends from those regions eastward to Yunnan and the Pacific coast of South China, thence southward in suitable localities to Indo-China. Anderson, who found it in the Kakhyen Hills on the border of southwestern Yunnan and Burma, says that it "seems to be essentially a hill or mountain form—that is, occurring only in the mountainous regions of Cachar, absent in the valley of the Irawady, but stretching round it into Yunnan from Upper Assam, being doubtless distributed over the mountainous region that intervenes between the Irawady and Cochin-China." He named specimens from the Yunnan border, *Macacus brunneus*, but later regarded them as identical with *L. speciosus*. His account of the anatomy, in the "Anatomical and Zoological Researches," gives a summary of the history of the species and something of the structure. Howell, who had occasion to compare skins of this macaque from Mount Omei, central Szechwan, regards it as different from the coastal form. In China the range of this macaque extends from the border of western Yunnan northwestward into central Szechwan, to the principality of Muping, whence the specimens described by Milne-Edwards are supposed to have come. Except for the three from Mount Omei in the same province (Howell, 1929), no others seem to have been recorded.

Specimens examined:—None.

147. **Lyssodes speciosus melli** (Matschie)

Macacus (*Magus*) *arctoides melli* Matschie, Sitzungsb. Ges. Naturf. Freunde, Berlin, 1912, p. 308. Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 10, 1922.
Macacus arctoides Trouessart, Cat. Mamm. Viv. Foss., p. 27, 1897 (in part).
Macacus (*Magus*) *arctoides esau* Matschie, Sitzungsb. Ges. Naturf. Freunde, Berlin, 1912, p. 309.
Pithecus pullus A. B. Howell, Proc. Biol. Soc. Washington, vol. 41, p. 41, 1928; Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 34, 1929.

Type specimen:—The type is a male, skin and skull, No. 15925, in the Berlin Museum. The specimen came originally from the mountains west of Lochangho, western borders of Kwangtung. This animal, as well as the one that formed the type of Matschie's *Macacus arctoides esau*, was sent from Canton to the Berlin Zoölogical Gardens by Mell. On the death of the animals, they both were sent to the Museum.

Description:—Similar to the typical form, but "uniformly of a chocolate color with the suggestion of a golden sheen" (Howell). The general color is chocolate brown above, including the tail and outside of limbs; below and on the sides of the head, grayish. On the shoulders the hair is gray at the base; then comes a broad brown ring, and a tendency to have an indistinct subterminal gold band and a blackish tip. In none of five specimens was the annulation of the hairs seen such as is described in adults of the race *L. s. thibetanus*. The face in the type was scarlet, but in the second specimen the naked skin was said to be flesh-colored. Evidently the height of color is an individual matter, depending perhaps on the age, condition, or individual nature of the specimen. Yet it was on this difference that the name *esau* was proposed!

According to Howell, the skull has the posterior nares narrow and high, as characteristic of the monkeys of this genus, but this character is less marked than in *L. s. thibetanus*, and the bullæ are less prominent.

Measurements:—The measurements of a male, not fully adult, are given by A. B. Howell (1928) as follows: head and body, 605 mm.; tail, 66; hind foot, 181; ear, 38 (collector's field measurements). A slightly larger male collected by Clifford H. Pope at Chunganhsien, measured 613 mm. in length; tail, 55; an adult female from the same place, 507 and 56 mm. for the same dimensions.

CRANIAL MEASUREMENTS OF *LYSSODES SPECIOSUS MELLI*

No.	Greatest length	Condylobasal length	Palatal length	Orbit to end of premaxilla	Zygomatic width	Mastoid width	Width across orbits	Width of brain case	Width across molars	Upper c—m^3	Lower c—m_3	Sex	Locality
60160	149	120	64.0	55.0	103	78	76.0	69	47.5	51.0	56	♂	Fukien
84471	150	114	58.0	54.5	100	77	73.0	69	45.5	53.0	58	♂	Fukien
84472	163	127	66.5	60.0	107	78	79.0	68	46.0	51.0	57	♂	Fukien
84473	126	94	46.0	38.0	82	65	64.0	70	40.0	41.5	46	♀	Fukien
84474	133	100	54.0	44.0	92	69	73.5	70	40.0	41.5	46	♀	Fukien

Occurrence and Habits:—So far as present records go, this macaque is known from the mountainous district of northwestern Fukien southward along the coast region of China, and in the Provinces of Kwangtung and Kwangsi. Mell (1922) writes that his hunters brought him a live male from the mountains northwest of Lihnshan which would be on the southern borders of Hunan. He purchased a second male in the market at Canton that was said to have come from Kwangsi. He was told also of a red-faced rock ape

found in the Bakshan (North Mountains) north and northeast of the city of Chichin, Kwangsi. The individual that served as the type of Matschie's *Macacus arctoides esau* was a male from the mountains west of Lochangho. These mountains (113° East, 25° North), in northern Kwangtung, are difficult of travel, hard to reach, and thinly peopled. Here, at about 2,000 meters altitude, these monkeys are said to be not rare. Mell saw them only singly and on rocky mountains, rather than in woods. Red-faced animals and those with flesh-colored faces occurred together. Mell mentions a tame albino in the house of a Chinese, and speaks of an animal in captivity that in a few weeks' time became bald. The occurrence of this species at Kuatun, northwestern Fukien, was noticed by A. B. Howell (1929), who described as *Pithecus pullus* a splendid specimen sent to the U. S. National Museum by Arthur de C. Sowerby. There seems to be little doubt, however, that this is the same as the form named by Matschie from Kwangtung. The American Museum Asiatic Expeditions secured a small series at Chungan in northwestern Fukien. Further research may prove the presence of the Stump-tailed Macaque quite across southern China, and thence southward, where it no doubt intergrades with *Lyssodes speciosus*, if indeed it is really very different from that animal, or from *L. harmandi* described from the mountains between Cambodia and Siam.

Mr. Clifford H. Pope, who secured several at Chunganhsien, writes that they prefer the more rugged precipitous sections. He adds that monkeys are certainly to be found in the border region between Futsing and Yungtai, in eastern Fukien. The Chinese name for this species is "ching-p'i-hou."

Specimens examined:—Five skins and three odd skulls, all from Chunganhsien, Fukien.

Family COLOBIDÆ

LANGUR MONKEYS

The langurs and the snub-nosed monkeys appear to represent in Asia the same group of leaf-eating species as the Colobus Monkeys do in Africa. In correlation with these habits of diet, the stomach is enlarged by being thrown into a number of sacculations. The fore and hind limbs are subequal and the tail very long. Some of the species have an erect peaked crest of stiff hairs on the head, but in others this is lacking.

Two genera are found in China, the typical langurs of the genus *Pithecus*, and the so-called Golden Monkeys of the genus *Rhinopithecus*. These may be distinguished as follows:

Key to Genera of Chinese Colobidæ

A. Nose normal, without expansions of skin..... *Pithecus*
B. Nose expanded and upturned..... *Rhinopithecus*

Genus **Pithecus** Geoffroy and Cuvier

LANGURS

Pithecus Geoffroy and Cuvier, Mag. Encyclopédique, vol. 3, p. 462, 1795.
Pygathrix Geoffroy, Ann. Mus. d'Hist. Nat., Paris, vol. 19, p. 90, 1812.
Presbytis Eschscholtz, Kotzebue's Entdeckungs-Reise Sud See und nach Berings-Strasse, vol. 3, p. 196, pl., 1821.
Semnopithecus F. Cuvier, Dents des Mammifères, p. 247 (14, 16, pl. 4), 1825.

The langurs differ in many details from the macaques and their relatives the baboons. They are essentially tree-living monkeys, with leaf-eating habits, for which their large sacculated stomach is adapted, in order to give additional absorptive surface. They are slender-bodied, with relatively long limbs, long tails, small thumbs, and small naked ischial callosities. The hair of the head is sometimes elongated to form a crest. Cheek pouches are absent. The first and second lower molars have each four cusps, the third an additional posterior one. The muzzle is shortened and weak. The genus is confined to the southeastern part of Asia and the East Indies, at least two species barely reaching the borders of subtropical China in Yunnan and Kwangsi, with a third slightly aberrant species on Hainan. The correct application of the generic name *Pithecus* has been a subject of much controversy, but as pointed out by Thomas, it should pertain to the langurs, with *Simia veter* of Linnæus as the type. This name is based on one of two species of Ceylonese langurs, but just which is held to be indeterminate. Since both are congeneric, the standing of the name *Pithecus* is not affected.

The following key will identify the forms hitherto known from China.

Key to Chinese Species of *Pithecus*

A. General coloration blackish to dark gray.
  a. Rump and anal region dark like the back.
    a′. General color silvery gray, without a white cheek patch from mouth to base of ear..... *P. obscurus barbei*
    b′. General color black, with a white band from mouth to base of ear.. *P. françoisi*
  b. Rump and anal region contrastingly white..... *P. nemæus*

148. **Pithecus obscurus barbei** (Blyth)

BARBE'S LANGUR

Presbytis barbei Blyth, Journ. Asiatic Soc. Bengal, vol. 16, p. 734, 1847.
Semnopithecus barbei Anderson, Anat. and Zool. Researches Western Yunnan, p. 12, 1879.
Pygathrix barbei Elliot, Review of the Primates, vol. 3, p. 48, 1913.

Type specimen:—The original specimen on which this species is based was said by Elliot (1913) to be preserved in good condition in the Indian Museum at Calcutta. It was supposed to be from the Province of Ye, Tenasserim, southeastern India, but Anderson showed that it came from the Tippera Hills, in eastern India.

FIG. 13. Distribution Map.
Pithecus

1. *P. obscurus barbei*
2. *P. françoisi*
3. *P. nemæus*

Description:—General coloration silvery gray with blackish face and forehead, adults of both sexes similar. Across the forehead is a fringe of long black hairs; those of the sides of the head and crown do not form a crest but are directed backward. The color becomes drab gray on the crown, paler buffy gray on the nape, and silvery gray on the back, flanks and upper parts of the limbs and the tail, faintly washed across the shoulders with pale buff. Most of the forearm and the hands and feet are contrastingly dark, almost blackish. Chin and a few hairs on the upper lip medially, whitish. Lower surface of the body and of the upper arms pale silvery gray. Tail silvery gray, darkening slightly at the tip. Face covered with short, scattered black hairs. Individuals show some variation in the amount of buffy wash across the upper back.

Young individuals are contrastingly different in color from the adults. A very young one taken March 6 is entirely fulvous, except the tail which is slightly darkened with dusky hairs. A somewhat older animal, hardly larger, has lost this youthful coat and is a uniform dusky gray with blackish feet, though the tail still retains a considerable fulvous tinge.

In the skull the lambdoid ridges of old males develop as little flanges along the occipital edge; the temporal ridges meet only in fully adult or old

males, but are usually barely indicated ridges of lyrate outline. The canines become much worn on the front face in adults, and have sharp cutting edges. Characteristic of the skull are the short broad nasals, truncate across both above and below.

Measurements:—This is a rather small species, and, although no flesh measurements are at hand, a tanned skin is 1,410 mm. long, of which the tail is 760.

CRANIAL MEASUREMENTS OF *PITHECUS OBSCURUS BARBEI*

No.	Greatest length, excluding incisors	Condylobasal length	Palatal length	Orbit to gnathion	Zygomatic width	Mastoid width	Width outside m^2	Width across orbits	Upper c—m^3	Lower c—m_3	Sex	Locality
43075	111.3	90.0	39.0	31	79.0	65	36.0	68.5	34.0	38.0	Ad. ♂	Yunnan
43078	108.0	88.0	41.5	33	——	—	37.0	——	35.0	39.5	♂	Yunnan
43071	102.0	83.0	35.0	29	76.8	62	35.4	59.6	32.5	38.0	♀	Yunnan
43076	103.0	83.7	36.0	29	71.0	61	34.0	65.0	34.5	39.0	♀	Yunnan
43079	98.0	80.5	33.0	25	74.0	61	35.3	61.0	33.5	38.0	♀	Yunnan

Occurrence and Habits:—Although obviously a member of the *P. obscurus* group, with crestless head, generally dark-gray body, and blackish feet, and having a fulvous coat in the baby stage, there is nevertheless some uncertainty as to which of the published names should be used for this monkey. It seems to agree closely with the description of *P. barbei*, to which I have therefore referred the specimens from extreme southwestern Yunnan, on the Namting River, secured by the American Museum Asiatic Expeditions. Elliot's *P. melamera*, type locality of which is Bhamo, not far away over the border in Burma, is said to differ by having the legs uniformly sooty, but it seems likely that this character is variable, and that *P. melamera* is really the same as *P. barbei*, to which in 1879, Anderson had referred specimens from the Kakhyen Hills. The present record of specimens from the Chinese side of the Yunnan border, at the Namting River and Homushu Pass, seems to be the first definite one for the country.

Specimens examined:—In all, thirteen, as follows:

Yunnan: Namting River, 6; Homushu Pass, 3; no exact locality, probably one of these, 4.

149. **Pithecus françoisi** (Pousargues)

FRANÇOIS'S LANGUR

Semnopithecus françoisi Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 4, no. 7, p. 319, 1898. Trouessart, Nouv. Arch. Mus. d'Hist. Nat. Paris, ser. 5, vol. 4, pt. 2, p. 273, pl. 2, 1912.
Pygathrix françoisi Elliot, Review of the Primates, vol. 3, p. 68, 1913.

Type specimen:—The type is in the Muséum d'Histoire Naturelle at Paris. It came from the Province of Kwangsi, China, just across the border from Tongking. According to Trouessart, it is No. 116a of the Galeries de Zoologie in the Museum.

Description:—The type is described as black, except for a white band from the angle of the mouth across the cheeks to the ears; the head has a slight crest.

Measurements:—Elliot (1913), who examined the type in Paris, gives its measurements as follows: total length, 1,231.9 mm.; tail, 748.7; hind foot, 139.7.

Skull: total length, 97 mm.; occipito-nasal length, 83; Hensel, 64; zygomatic width, 76; intertemporal width, 48; palatal length, 28; width of brain case, 60; median length of nasals, 11; upper molar series, 26; lower molar series, 31; length of mandible, 63.

Occurrence and Habits:—This is another of those subtropical species that just reach the southern edge of China. Little seems to be known of it. It was first brought to notice by M. François, the French Consul at Lungchow, Kwangsi, China, who secured specimens on the great cliffs along the River Longkiang or Sikiang, near that place. Mell (1922, p. 11) quotes Dewall ("Reiseberichte durch Kuangsi"), who mentions flocks of small black monkeys with long tails and white heads, seen on rocky shores between Nanning and Kuohua. Dewall's best Chinese collectors were unable to secure any, however. He adds that the native name is "wu-yuen". Thomas (Proc. Zool. Soc. London, 1928, p. 142) records additional specimens secured by the Delacour Expedition to Indo-China, carrying the range southward into that country; these are a male from Bac-kan, and a male and a female from Langson, Tongking. Its rock-loving habits were noted by the collector. Thomas states that it is a species closely allied to his *P. laotum*, which is fond of similar situations. A colored figure of the animal is published by Trouessart (1912, pl. 2) taken from the type.

Specimens examined:—None.

150. **Pithecus nemæus** (Linnæus)

Simia nemæus Linnæus, Mantissa Plantarum, p. 521, 1771.
Pygathrix nemæus Geoffroy, Ann. Mus. d'Hist. Nat., Paris, vol. 19, p. 90, 1812. Thomas, Proc. Zool. Soc. London, 1911, p. 127; *ibid.*, 1927, p. 43. Elliot, Review of the Primates, vol. 3, p. 98, 1913.

Semnopithecus nemæus A. B. Meyer, Proc. Zool. Soc. London, 1892, p. 665. J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 489, 1906.

Type specimen:—Not known to be in existence. The type locality is Cochin China, based on Pennant's Cochin China Monkey.

Description:—Fore part of the head, the shoulders and a band across the chest, the inner side of the elbows and thighs, the hands and feet, black; back of head to the rump, the flanks and arms to below the elbows, iron gray; outer side of forearms yellowish white; legs maroon; a broad ochraceous-rufous collar on the chest above the black bar passes around the neck to above the shoulders; whiskers and throat, the rump, anal region, tail and thighs beneath, white; under parts of body yellowish brown speckled with white (Elliot). The head is not crested.

The sexes are alike in color and the very young individuals are similar to their parents.

Measurements:—No measurements of the Hainan animal are available. Elliot states that the total length is 1,230 mm.; tail, 610; hind foot about 180.

Occurrence and Habits:—This monkey occurs in Hainan, and on the adjacent mainland of northeastern Cochin China, affording another example of the many close similarities between the faunæ of these two areas, which, though now separated by a narrow stretch of sea, may once have been united. No doubt it grades into *P. nigripes* of Saigon, farther to the south, the form occurring about the mouth of the Mekong. It is a species of peculiar color pattern, with its conspicuous white rump and tail, a pattern and coloring, morevoer, that are present in the very young animals as well. In view of these peculiarities and the fact that the basal axis of the cranium is far more strongly inclined, making a greater angle with the bones of the face than in most members of *Pithecus*, causing the posterior nares to assume a much greater height, Thomas would regard these two monkeys as constituting a separate genus *Pygathrix* Geoffroy, 1812, of which *P. nemæus* is the type species. The validity of these characters as generic distinctions is denied by Elliot and by Pocock, though the former makes *P. nemæus* and its relative *nigripes* members of a special subgenus, *Pygathrix*.

The present species was first recorded from Hainan, apparently, by A. B. Meyer (1892), on the basis of a male received from that island by the Royal Zoölogical, Anthropological and Ethnographical Museum of Dresden. It must be rare there, for no one before or since appears to have mentioned it or secured specimens from Hainan.

Specimens examined:—None.

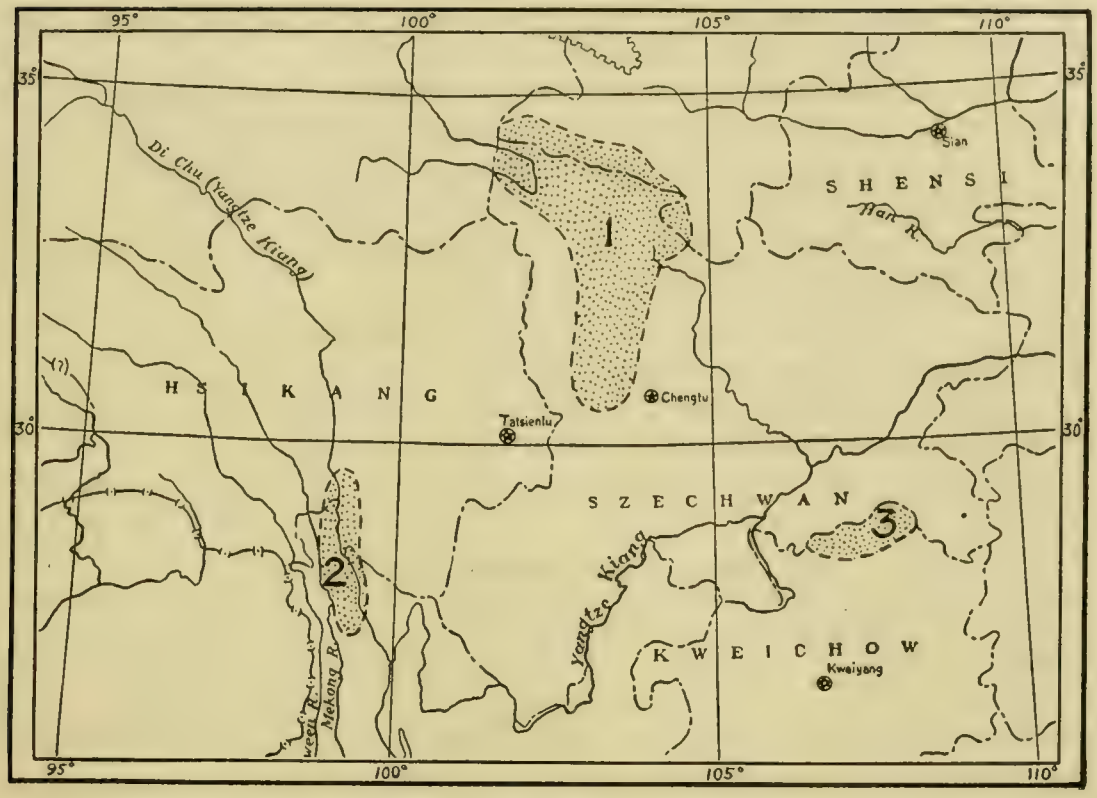

FIG. 14. Distribution Map.
Rhinopithecus

1. *R. roxellanæ*
2. *R. bieti*
3. *R. brelichi*

Genus **Rhinopithecus** Milne-Edwards

SNUB-NOSED MONKEYS

Rhinopithecus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 233, 1868-74.
Semnopithecus Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 70, p. 341, 1870.

For the remarkable Snub-nosed Monkeys of western China, Milne-Edwards proposed the genus *Rhinopithecus*, of which the type species is the animal described by him as *Semnopithecus roxellana*. The genus is close to *Pithecus*, lacking cheek pouches, and having presumably the sacculated stomach of that group. The characters upon which the genus was based, however, are the peculiar upturned and prominent nose, and the proportions of the limbs and body. For the limbs are much less slender than in the Langur Monkeys, the hind limbs more nearly equal to the fore, in which the humerus is longer than the forearm, instead of shorter. The trunk, too, is thick-set, and less slender than in the related genera, the tail relatively shorter.

The skull is peculiar in its smoothly rounded brain case, the great reduc-

tion of the nasal bones, and in the large size of the nasal aperture. The teeth are somewhat broader proportionally than in *Pithecus*.

Three species are known from China, all inhabitants of the high country of the western part. A fourth species, first described as *Rhinopithecus avunculus*, from Tongking, and later made the type of a special genus, *Presbytiscus*, may eventually be found to occur on the extreme southern edge of China.

The three Chinese species may be known by the following characters, given by Elliot (1913) in his key to the genus.

KEY TO THE CHINESE SPECIES OF *Rhinopithecus*

A. No light patch between the shoulders.
   a. Sides of face, chest and hind legs rufous..... *R. roxellanæ*
   b. Sides of face white, center of chest brown..... *R. bieti*
B. A light patch between the shoulders..... *R. brelichi*

151. **Rhinopithecus roxellanæ** (Milne-Edwards)

GOLDEN MONKEY

Semnopithecus roxellana Milne-Edwards, Compt. Rend. Acad. Sci., Paris, vol. 70, p. 341, 1870.
Rhinopithecus roxellanæ Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 233, pls. 36, 37, 1868-74. Elliot, Review of the Primates, vol. 3, p. 102, col. pl. 3, crania, pl. X, 1913.
Semnopithecus (nasalis) roxellanæ Anderson, Anat. and Zool. Researches Western Yunnan, p. 43, 1879.

Type specimen:—The type is a mounted specimen in the Muséum d'Histoire Naturelle at Paris, but "so faded from exposure to light" that Elliot (1913) regarded its color characters as wholly unreliable. It was one of the discoveries of Père Armand David in the principality of Muping, central Szechwan, China.

Description:—Coloring bright and handsome in the male. The top of the head, nape, shoulders, upper parts of the arms, back and tail, grayish black, the back more or less overlain with long silvery hairs; tail tip whitish; forehead, sides of the head to and including the ears, and sides of neck, and under surface of body and limbs, ochraceous rufous, this color extending to the hands and feet, and the outer and inner borders of the hind leg.

The female is similar, but the head and upper parts, and the outer side of the limbs are brownish black, the rufous tints less deep, and a patch on the upper part of the thigh and the anal region whitish (Elliot, 1913).

Measurements:—The total length of the type specimen, an adult male, was 1,320 mm., of which the tail was 610; Elliot gives 1,270 and 700 respectively for the same dimensions from a skin in the British Museum. Milne-Edwards (1868-74, p. 241 f.) gives a table of various measurements of his largest specimen.

The cranial dimensions of an adult male and a female as given by this

author, as well as those of a skull in the British Museum by Elliot, are as follows:

CRANIAL MEASUREMENTS OF *RHINOPITHECUS ROXELLANÆ*

	Total length	Occipito-nasal length	Palatal length	Zygo-matic width	Width outside orbits	Upper molar series	Lower molar series		Sex
PARIS	119	—	45	—	76	33	40	(Milne-Edwards)	♂
PARIS	116	—	45	—	76	33	39	(Milne-Edwards)	♀
LONDON	129	96	46	99	90	33	40	(Elliot)	♂?

Occurrence and Habits:—The beautiful Golden Monkey was one of the many remarkable mammals first brought to the notice of Europeans by Père Armand David, whose hunters secured an adult male and female and a younger animal in the principality of Muping, central Szechwan. A brief account of these specimens was given by Milne-Edwards in 1870, under the name of *Semnopithecus roxellana*, but in his later work (1868-74) he founded for it the new genus *Rhinopithecus* and corrected the spelling of the specific name to *roxellanæ*. His account of the skeleton and the colored plate of the exterior, as well as De Winton's colored figure (in De Winton and Styan, 1899, pl. 31), reproduced by Elliot together with figures of the skull, give a fair idea of the peculiarities of the animal.

The Golden Monkey ranges through the high mountain forests of western Szechwan (district of Yaochi) to the borders of Tibet and north into southern Kansu. Thus, as Milne-Edwards wrote, it is undoubtedly one of the most resistant of all monkeys to cold, living as it does in areas where snow covers the ground during more than half the year. According to the hunters employed by David, these monkeys live in large troops among the bigger trees, subsisting on fruits, buds, or at times on leaves or the young shoots of bamboo. Williston (1926), while at Longanfu, western Szechwan, had eleven skins brought in to him by local tribesmen. He adds that it is the most valuable of the furs to be obtained there, for it is believed to keep off rheumatism (as Père David also was told) and formerly might be worn only by Manchu officials. The animals are hard to capture, as they live in country where the snow is deep, and, though keeping chiefly to trees, come to the ground for water. The Russian explorer Berezovski secured a skull of an adult and the skins and skulls of two other males not far from Ssigu, in southern Kansu, thus considerably extending its known range from Muping. It was rare there, however, but to the westward, in the country inhabited by the Tebbu, it is more common, going in large bands of a hundred or more, chiefly in the pine woods at ten thousand feet or so in summer, but descending in winter to the lower cultivated levels. Berezovski's notes, as quoted by Buechner (1892), add that the bare skin about the eyes is pale bluish in life and that the nose

turns up nearer the forehead than is indicated in Milne-Edwards's figure. The Chinese, whose name for this monkey is "ssian-shun," bring in many skins of it yearly to Chengtufu, the chief city of Szechwan, and obtain a high price for them. Fergusson (1911, p. 124) writes that when he was in the vicinity of Yinhsiuwan, northwest of Chengtu, a hunter brought in two that had just been shot. They were carefully skinned and sent to the British Museum, where one is now mounted on exhibition. "These monkeys . . . have bright blue faces and dark brown eyes; their nose looks as if a bright blue butterfly was sitting with its wings open in the middle of their face . . . At Kwanhsien I saw a skin with hair eighteen inches long and valued at £12 15*s*." It was in nearly this same region, near the town of Luchingsha, some twenty miles north of Muping, that the brothers Theodore and Kermit Roosevelt (1929) came upon a troop of these monkeys in high forest at an altitude of about 8,000 feet, and secured nine adults, while their hunters on a neighboring slope killed another and a "new-born" young about March 20, 1929. These specimens are in the Field Museum of Natural History, Chicago. De Winton and Styan (1899) record a male and a female secured at Yangliupa, in western Szechwan, and figure the former in colors. Sowerby notes that the fur is often seen on sale in Shanghai markets. Except for these meager notes, nothing seems to have been recorded of its habits, and few specimens have found their way into museums.

Specimens examined:—One, mounted, from Yinhsiuwan, Szechwan (B. M.)

152. **Rhinopithecus bieti** Milne-Edwards

Rhinopithecus bieti Milne-Edwards, Bull. Mus. d'Hist. Nat., Paris, vol. 3, p. 157, text-fig., 1897. Milne-Edwards and Pousargues, Nouv. Arch. Mus. d'Hist. Nat. Paris, ser. 3, vol. 10, p. 121, pls. 9-12, 1898.

Type specimen:—No type was designated in the original description, but, of the seven specimens mentioned, the "mâle très adulte" might be selected as the type. It came with the others from Kiape, a day's journey from Atuntze, northwestern Yunnan, China. It is probably this specimen, the measurements of which are given by Elliot, that he regarded as the "type."

Description:—The color pattern is much like that of *R. roxellanæ*, but the grayish black of the back is replaced by light brown and the golden of the under parts, sides of the head and the back of the haunches is replaced by white. The head has a median crest, beginning just behind the brow, almost black, with longer hair in front, curving over the brows. The back of the head is gray, with darker eyebrows, and a border of longer hairs, white at their base and black at the tip, surrounding the face. On the upper lip scattered black hairs form a slight mustache. Upper surface of body, flanks, outer side of arms, and front of the thighs, hands, feet and tail, black, with a

brownish tinge, the hands especially deep black. The longest hair of the shoulders and back may reach a length of 150 mm. The inside of the arms, the throat, sides of the neck, and the buttocks and posterior part of the thighs are contrastingly white. In the adult female the crest is less obvious and the white areas less clear, but tinted somewhat with drab or brownish. The very young animal is white, with blackish areas at the occiput, along the middle of the back, and on the outer side of the limbs.

Measurements:—Milne-Edwards gives the following dimensions of an old male, an adult and a subadult male, and an adult female.

	Old ♂	Ad. ♂	Ad. ♀	Subad. ♂
Length from end of muzzle to root of tail	820	830	740	610
Length of tail	720	680	510	520
Foot (fide Elliot)	231	—	—	—

CRANIAL MEASUREMENTS OF *RHINOPITHECUS BIETI*

	Old ♂	Ad. ♂	Ad. ♀	Subad. ♂
Greatest length	135	120	117	88
Zygomatic width (fide Elliot)	103	—	—	—
Length from foramen magnum to incisive border	—	82	78	48
Palatal length	54	47	45	26
Upper molar series (fide Elliot)	34	—	—	—
Lower molar series (fide Elliot)	43	—	—	—

Occurrence and Habits:—The range of this fine species is apparently to the west and south of the area where the Golden Monkey is found. The first knowledge of it is perhaps due to the indefatigable Père Armand David, who, while in central Szechwan, in 1871, wrote that the Chinese who have traveled to the south of the Yangtze told him of having seen there, in summer, large black monkeys with long tails, in the country of the Miaotze of the South. He was, however, unable to secure any specimens, nor were Prince Henri d'Orléans and M. Bonvalot, who in 1890 saw them in the forest country between Tengri Nor and Batang, any more successful. On a later journey, Prince Henri left ammunition and guns with R. P. Soulié, who was to stay in the western country of Yunnan in order to secure this monkey when the winter conditions should make hunting easier. With the assistance of Monseigneur Biet, in charge of the mission work of the district, organized hunts were made in the forests covering the western slope of a mountain range that separates the valley of the Mekong from that of the Yangtze. These efforts finally succeeded in procuring for the Paris Museum seven specimens of this monkey, representing all ages. A preliminary account with a figure was published by Milne-Edwards in 1897, followed in 1898 by a fuller description with beautiful plates of the adult and young, the skull and dentition. This

is a larger species than *R. roxellanæ* and strikingly different in color, though with a similar pattern of coloration.

Since no one seems to have observed or taken this monkey since the original series was captured, it may be best to give the localities in full from Milne-Edwards and Pousargues's account. Their very old male and a subadult male were collected at Kiapé, a day's journey from Atuntze, on the left bank of the Mekong River, in extreme northwestern Yunnan; and a third male, adult, was killed near Atuntze, again on the left bank of the river. The four other specimens, including an adult female, two young males, and a very young specimen of undetermined sex, were from Djra-gniéra, not far from Tsikou, left bank of the Mekong. Here, in a high, mountainous country covered with forests of conifers and rhododendron thickets, these monkeys seem to have a very restricted range. The native name is said to be "tchru-tchra," meaning Snow Monkey. Milne-Edwards supposes that in summer they range across the dividing ridge of mountains to the eastern side and into the Yangtze basin, while in winter they may move back to the western slopes of the Mekong drainage.

Specimens examined:—None.

153. **Rhinopithecus brelichi** Thomas

Rhinopithecus brelichi Thomas, Proc. Zool. Soc. London, 1903, vol. 1, p. 224, pl. 21. Elliot, Review of the Primates, vol. 3, p. 105, 1913.

Type specimen:—The type is a hunter's skin without skull, female, No. 3.3.14.1, British Museum, from an unknown locality, but probably from northern Kweichow, China. Collected by Henry Brelich.

Description:—A very large monkey, apparently attaining a larger size than either of the two other species of the genus and hence the largest living species outside the anthropoids. Fur longest on the flanks, where it attains a length of about 90 mm. Fur of the back to the roots of the hairs, slaty gray, with shining tips, except that in the midline between the shoulders is a large oval patch of white, the hairs white to their roots. Crown suffused with yellowish, its hair yellow at the base, whitening terminally, but broadly tipped with black; cheeks similar; nape brownish with black tips. Ears contrastingly white. Front of shoulders and inner side of forearms deep yellow, shading into whitish along their under sides; wrists black (hands missing in the type specimen). Hind limbs light grayish, more or less suffused with yellow behind and blackish in front. Belly uniformly gray. Tail very long, its hairs curiously parted and curving from the center line downward, its color black throughout, with a very short white tip. A small yellow patch on each side of the root of the tail.

Measurements:—The skin, as made up, measures: head and body, 730 mm.; tail, 970 (with hairs 1,040).

Occurrence and Habits:—The type and only known specimen of this large monkey was secured by Henry Brelich from a native hunter, and considerably extends the range eastward of the genus *Rhinopithecus*. So far as could be gathered by Mr. Brelich, "this monkey inhabits a range of mountains known as the Van Gin Shan Range, about 108° E., 29° N., in the north of the Province of Kwei-chow." Nothing further is known of it. Obviously in its dark dorsal surface and yellow shades on the inner sides of the arms and legs, it bears a slight resemblance to *R. roxellanæ*. The male, when it is known, no doubt will prove to be more brightly colored.

Specimens examined:—None.

Family HYLOBATIDÆ

GIBBONS

The gibbons, including the siamang of Sumatra and the Malay Peninsula, are commonly associated with the anthropoid apes but as a distinct family. Their extremely long arms are adapted for their peculiar method of progression by "brachiation," swinging or hurling themselves from limb to limb, through the forest, passing "with incredible speed . . . from bough to bough, and tree to tree, in many a graceful swing and curve, rivalling in its swift flight that of the feathered inhabitants of its leafy abode" (Elliot, 1913, vol. 3, p. 149). The forearm is longer than the humerus, and the hand with its long thumb exceeds the foot. The tail is lacking, a feature correlated perhaps with its modes of progression, and there are small ischial callosities. Miller (Journ. Mammalogy, vol. 14, p. 158, 1933), the latest to review the superspecific relationships of the species, places them in four subgenera, of which two occur in southern China, namely, the Black Gibbon of Hainan (subgenus *Nomascus* Miller) and the Hoolock Gibbon, type of the typical subgenus *Hylobates*. The former is distinguished among other characters by the hair of the vertex being directed upward, and by having the profile nearly straight from the front of the nasals to the upper margin of the orbits; the latter has the hair of the vertex directed backward and the skull profile strongly curved (often double curved) from the front of nasals to upper margins of the orbits.

Genus **Hylobates** Illiger

Hylobates Illiger, Prodromus Syst. Mamm. et Avium, p. 67, 1811.

The type of the genus is the *Homo lar* of Linnæus, the gibbon of the southeastern corner of India and the Malay Peninsula. The striking characters, in addition to the disproportionately long fore limbs, small ischial callosities,

and lack of external tail, are the rather smoothly rounded skull with its large brain case, the prominent eyebrow ridges, well-developed canines, very slightly convergent tooth rows, and the arrangement of the tooth cusps of the molars in such a way that in the upper teeth they do not form two transverse rows as in the macaques and baboons, but instead they alternate slightly, with the two inner cusps (protocone and hypocone) standing each a little behind the transverse level of the two outer ones. The last lower molar has no fifth or posterior cusp as it has in the Cercopithecidæ, but the tooth formula is the same: $i.\frac{2}{2}$ $c.\frac{1}{1}$ $pm.\frac{2}{2}$ $m.\frac{3}{3} = 32$.

Two species occur in China, the Hoolock of India, which reaches the western edge of Yunnan, and the Black Gibbon of the island of Hainan and adjacent mainland. The adult males are usually black and adult females usually pale, more or less whitish or yellowish white. The two forms hitherto known from Chinese territory may be identified by the following key:

KEY TO THE CHINESE SPECIES OF *Hylobates*

A. Males black with a white brow band; hair of the crown directed backward; female with clitoris not elongated..... *H. hoolock*

B. Males black, without a white brow band; hair of crown forming an erect mat; females with clitoris so elongate as to be peniform..... *H. concolor*

154. **Hylobates hoolock** (Harlan)

THE HOOLOCK

Simia hoolock Harlan, Trans. Amer. Phil. Soc., new ser., vol. 4, p. 52, pl. 2, 1834.
Hylobates hoolock Waterhouse, Cat. Mamm. Mus. Zool. Soc. London, ed. 2, p. 3, 1838. Anderson, Anat. and Zool. Researches Western Yunnan, p. 1, 1879. Elliot, Review of the Primates, vol. 3, p. 156, 1913. Pocock, Proc. Zool. Soc. London, 1927, p. 719.

Type specimen:—The type was a skin and skull of an adult male that came from the Garo Hills, near Goalpara, Assam, and was one of three that had lived for some time in the possession of Dr. M. Burrough, about 1830. The specimen is possibly still in Philadelphia.

Description:—Hair of the crown directed smoothly backward, not forming an erect mat. The adult male is typically a brownish black, more intense on the lower limbs and feet; the under side deep chocolate brown; a white band is present across the brow, narrowly interrupted in the median line. Rarely the coloration is pale whitish or yellowish white as in the female. The adult female is contrastingly pale in color. The hair on the face and surrounding it is nearly clear white with a few stiff black hairs over the eyes; the chin, hands, feet and upper chest are also white. The rest of the body is soiled white tinged with pale brown, with some range of variation in which the body may be darker, nearly drab brown on body and limbs, with pale head and

Hoolock Gibbon (*Hylobates hoolock*), female, killed near the Burma border, Yunnan. Profile view

Front view of the same

neck. Rarely the female may be "black faintly tinged with brown" (Pocock, 1927).

While the above description gives briefly the general coloration, there is much difference in individuals, as the following notes on a series secured on the southwestern borders of Yunnan by Dr. Andrews, indicate.

Male, subadult, No. 43067: entirely sooty above and on arms and legs; middle part of the throat, chest, and belly sooty brown; a narrow brow band, interrupted between the eyes; cheeks black.

Male, subadult, No. 43064: this specimen is the male specially mentioned in Dr. Andrews's book (R. C. and Y. B. Andrews, 1918, p. 254) as in the yellowish pelage, quite like a female in color, with chin, hands, feet and upper chest nearly white, the rest of the body soiled white, with a pale brown tinge; hair of the face nearly white with a few stiff black hairs over the eyes. This perhaps represents a retention of the immature condition, for, as Delacour has reported, the young of the Hainan Gibbon may be "yellow," in both sexes.

Male, subadult, No. 43068: slightly larger. Black tinged with sooty brown across the shoulders and nape. Cheeks black. Eyebrow band as before. Chest dark brown, lower abdomen blackish.

Female, large adult, No. 43065: in an intermediate coloring. Crown and nape soiled white, back and limbs grayish white, much tinged with sooty or drab brown; cheeks dark brown; throat, chest and belly and inside of legs dark brown. Eyes surrounded by a ring of white hair.

Female, subadult, No. 43090: hair of face nearly white with a few stiff black hairs over eyes; chin, hands, feet and upper chest nearly white; rest of body pale soiled white or gray, tinged with pale brown; top of head similar.

Measurements:—No measurements of the series from Yunnan were made in the flesh. Elliot (1913, vol. 3, p. 158) gives the following dimensions: head and body, 520 mm.; hind foot, 150.

In the skulls of the Yunnan series, none has the complete dentition in place, since the last molar has not yet reached the tooth line in any of them. The two largest skulls show the dimensions given below.

No.	Greatest length omitting incisors	Condylobasal length	Palatal length	Orbit to gnathion	Zygomatic width	Width of brain case	Width across orbits	Width outside m^2	Length of lower jaw	Median length of nasals	Locality
43063	93	75.5	32.0	20.5	—	60.5	55.5	32.0	63.5	10.0	Yunnan
43067	96	78.0	37.3	24.0	59	60.5	53.0	31.5	64.5	9.4	Yunnan

Occurrence and Habits:—This is the Gibbon of Upper Burma and Assam, but although Pocock (1927) has recently reviewed the group in the light of available material, it does not seem clear whether or not it should be regarded as a northern subspecies of the *H. lar* of Lower Burma and Siam, as seems most likely, or whether it is a wholly distinct species. Pending further study, however, he recognizes the two as separate species. The coloration of the gibbons is notoriously variable, so that many names have been bestowed from time to time upon them, but Pocock believes that only three continental species can be made out. As long ago as 1879, J. Anderson gave an account of his observations on gibbons seen in the Kakhyen Hills of eastern Upper Burma on the borders of Yunnan. Here while "passing through the magnificent defile of the Irawady, below Bhamo, where the river is enclosed by high hills, covered with dense forest . . . the air was resonant with the loud calls of this gibbon; large troops were answering each other from the opposite banks, and the hills echoed and reechoed the sound. The Hoolock is also common on the Kakhyen Hills, on the eastern frontier of Yunnan; and there, too, my attention was called to them at daybreak when they passed up from their sheltered sleeping-ground in the deep and warm valleys to heights of about 4,000 feet. We, in the middle distance, first caught a faint murmur of voices; but every minute it became more and more distinct, till at last the whole troop rushed past in a storm of sound, vociferating '*whoko*'! '*whoko*'! and in a few more minutes their cry was heard far up the mountain-side. Considering that their progress is almost exclusively arboreal, the rapidity with which they make their ascent is wonderful." Apparently Dr. R. C. Andrews was the first actually to secure specimens from within the borders of China, for in March and April, 1917, he succeeded in collecting a series on the Namting River and at Homushu Pass, in western Yunnan. At the former locality they were found feeding on a kind of large green bean. When pursued they "soon became extremely wild. Although the same troop could usually be found in the valley where we had first discovered them, they chose hillsides where it was almost impossible to stalk them because of the thorny jungle. Usually when they called, it was from the upper branches of a dead tree where they could not only scan every inch of ground below, but were almost beyond the range of a shotgun. . . . We went forward only when the calls were echoing through the jungle, and stood motionless as the wailing ceased. But in spite of all our care they would see or hear us. Then in sudden silence there would be a tremor of the branches, splash after splash of leaves, and the herd would swing away through the trackless treetops. . . . The gibbons were exceedingly difficult to kill and would never drop until stone dead. . . . Instead of running the animals would sometimes disappear as completely as though they had vanished in the air. After

being fooled several times we learned to conceal ourselves in the bushes where we could watch the trees, and sooner or later the monkeys would try to steal away" (R. C. and Y. B. Andrews, 1918). On another occasion, at Homushu Pass on the Salween River, gibbons were again found, but their habits seemed somewhat different. "Instead of sitting quietly in the top of a dead tree to call to their neighbors across the jungle for an hour or two, the hoolocks howl for about twenty minutes as they swing through the branches and are silent during the remainder of the day. They called more frequently on bright mornings and we seldom heard them during cloudy weather. Apparently they had regular feeding grounds, which were visited every day, but the herds seemed to cover a great deal of territory. Like the gibbons of the Namting River, the hoolocks traveled through the tree tops at almost unbelievable speed, and one of the most amazing things which I have ever witnessed was the way in which they could throw themselves from one tree to another with unerring precision" (R. C. and Y. B. Andrews, 1918). On several occasions Dr. Andrews found the gibbons most adept at hiding among thick leaves instead of making off. The food of the gibbon is said to be in part leaves, and in part animals, such as insects, or birds and their eggs. The gibbon, unlike many monkeys, is quite unable to swim, as Candler (Proc. Zool. Soc. London, 1903, vol. 1, pp. 187–190) proved experimentally by dropping one into a tank of water ten feet deep, in which it struggled helplessly and would have drowned had it not been rescued. No doubt the more nearly upright posture that is naturally assumed, as in the case of man, is not a favorable one for keeping afloat.

Whether or not gibbons are to be found elsewhere along the extreme southern edge of China, is still uncertain, though they have been killed so near the northern borders of Tongking that it can hardly be doubted they occasionally cross into southeastern Yunnan or western Kwangsi.

Specimens examined:—In all, seven, namely:
Yunnan: Homushu Pass, 3; Namting River, 3; no exact locality, 1.

155. **Hylobates concolor concolor** (Harlan)

BLACK GIBBON

Simia concolor Harlan, Journ. Acad. Nat. Sci. Philadelphia, ser. 1, vol. 5, part 2, p. 231, pls. 9, 10, 1826.
Hylobates harlani Lesson, Ferrusac's Bull. des Sci. Nat., vol. 13, p. 111, 1827.
Hylobates concolor Schlegel, Essai sur la Physion. des Serpens, Partie Gén., p. 237, 1837. Pocock, Proc. Zool. Soc. London, 1927, p. 719 ff.
Hylobates pileatus Swinhoe, Proc. Zool. Soc. London, 1870, p. 224 (in part).
Hylobates hainanus Thomas, Ann. Mag. Nat. Hist., ser. 6, vol. 9, p. 145, 1892. Pocock, Proc. Zool. Soc. London, 1905, vol. 2, p. 169, pl. 5.

Type specimen:—The type specimen is not known to be in existence. Harlan's name was based upon a female "lately" (that is, about 1826) living

in Philadelphia, said to have been imported from Borneo. On account of the latter statement, the type locality has been taken as Borneo, and the name assigned to the *Hylobates* of that island. Pocock (1927) has shown, however, that the anatomical features of the genitalia, illustrated by Harlan's plate, pertain to the all-black gibbon of Hainan and the adjacent mainland of Indo-China, whence the individual may thus have originally come. The name *concolor* is, therefore, transferred to the Black Gibbon.

Description:—The male is entirely black, lacking the white brow band of the other species, in the adult stage. The very young of both sexes are said to be pale or "yellow," soon turning black, the males remaining so the rest of their lives, but the females becoming pale again when grown. These changes, first announced by Delacour, have been confirmed by Pocock through observations of captive specimens in the Zoölogical Gardens at London. A young female, supposed to be about seven months old, was then blackish, or rather, smoky gray then blackish. At about seven years of age, when sexually mature, she became gray then pale. In the pale phase the color is buff, ochraceous buff, or grayish buff with a patch of black or dusky on the crown, extending on to the neck.

The skull of *H. concolor*, as pointed out by Pocock, has a different shape from that of *H. hoolock*, with the interorbital septum making no definite angle with the forehead, but rather lying in the same slope; the brow ridges do not form a continuous raised line across the forehead as they do in *H. hoolock*, but their inner portions are bent ventrally in over the base of the nose.

Measurements:—No measurements of Hainan specimens are available. Pocock gives the following skull measurements of a male: total length, 113 mm.; basal length, 80; palatal length, 43; zygomatic width, 78; width across orbits, 67; upper molars, 27.

Occurrence and Habits:—The Black Gibbon has long been known from Hainan. Its existence was reported there in 1735 by Du Halde in his "Description de la Chine." He writes (1738, English ed., p. 118): "This Island breeds a curious kind of great black Apes, whose Physiognomy very nearly resembles the Human, so distinct are the Features; but this species is scarce. There are others of a grey Colour, which are very ugly and common." Swinhoe (1870c), although himself unable to procure specimens, said it was well known to the natives who distinguished as different kinds, the yellow and the black, as well as the yellow with black face. Harlan, who described a female specimen, was the first to figure the unusually long clitoris, which is grooved longitudinally below, and depends like the penis of the male. He believed the individual to be for these reasons an hermaphrodite, but it is now known that these peculiarities are characteristic of the species, as has been more fully

described by Pocock (1905) on the basis of a female that lived for some time at the Zoölogical Gardens in London. An excellent plate accompanying this paper gives a good idea of the coloring. Few Europeans seem to have seen this gibbon in its natural haunts, but Malcolm A. Smith (1923) reports hearing them in the forest about Five-finger Mountain (Wuchih) in the early morning.

This species offers an interesting parallel in its distribution to *Pithecus nemæus*, which occurs not only on Hainan, but also in the adjacent portions of Tongking on the opposite mainland. The Black Gibbon of Tongking has been described as a separate species, distinguished by its white cheek patches even in the otherwise black males, whence its name, *H. leucogenys*. Pocock (1927) regards it as a subspecies of the Hainan animal, while the species described by Pousargues as *H. henrici* is really the female of it. It seems quite likely that this form will eventually be found to occur in extreme southern Kwangsi or Yunnan, for the localities whence the Tongking specimens came are very close to the Chinese border. Indeed, Swinhoe (1870c, p. 615) records that a black gibbon is said to occur in the mountains west of Canton, but no specimens have been received by European museums, nor did Mell, who spent several years in the region, report it.

Dr. F. D. Welch (1911), who studied living specimens in the London Zoölogical Gardens, concluded that the form of this gibbon is slenderer than that of *H. hoolock* and *H. lar*, and that the cry also differs, a "hoo hoo hoo," etc., while that of the Hoolock he represents by "hah hoo hah hoo," repeated a number of times.

Specimens examined:—None.

CHAPTER VII

ORDER CARNIVORA

CARNIVORES

THIS group comprises mammals whose habits are typically flesh-eating, although many to a greater or less degree subsist on vegetation, as in the bear family or in the case of the Giant Panda. They are often highly modified as compared with the primitive marsupial group or with the Insectivora. Some, as the dogs and wolves, retain nearly the full number of teeth characteristic of placental mammals, while in others, as the cats, the maxillary teeth are reduced in number and function. Some are cursorial, others arboreal, others again aquatic in their habits. Structurally the order lacks the specialization of the incisor teeth seen in the Insectivora, but instead these teeth form a transverse row between the canines and are typically three in number on each side of each jaw, the median ones smaller than the outer; the canines are usually enlarged, the cheek teeth sharp-cusped. A peculiarity is the development of the last upper premolar and the first lower molar to act together in a shearing fashion to cut up the food. This is brought about by a narrowing of these teeth from side to side and the enlargement of especially the anterior cusps. Unlike the Insectivora, the first digit of the hand and foot is usually much reduced or absent. As a primitive feature, many retain the entepicondylar foramen in the humerus, while as a matter of specialization, the cats have the last phalanx of the fingers and toes retractile, lifting the claw off the ground. The radius and ulna of the forearm are always separate, the former with usually the power of a certain amount of rotation, while in the hind leg the tibia and fibula are again always separate, as in the arboreal mammals.

Six or seven different families of Carnivora occur in China, of which the bear-like animals are the most primitive, the cats perhaps the most specialized. They may be identified by the following brief key:

KEY TO THE FAMILIES OF CHINESE AND MONGOLIAN CARNIVORA

A. Form stout, five well-developed toes on each foot.
   a. Tail more than half the body length; size not large; molars $\frac{2}{2}$, the upper only slightly wider than long (Panda, Raccoons, etc.)..... Procyonidæ

b. Tail very short; last upper molar with its least width about half the greatest length.
   a′. Muzzle short, the distance from its tip to the orbit less than half the greatest zygomatic width (Giant Panda) ..... Ailuropodidæ
   b′. Muzzle longer, the distance from its tip to the orbit more than half the zygomatic width (Bears)..... Ursidæ

B. Form slender, hind foot usually with four toes only.
   a. Limbs short, body disproportionally long.
      a′. Molars $\frac{1}{2}$, the upper transverse, with the inner lobe wider than the outer edge (Weasels, Martens, Otters)..... Mustelidæ
      b′. Molars $\frac{2}{2}$ (or $\frac{1}{1}$), the upper transverse, with the inner lobe narrower than the outer edge; cusps of lower carnassial of about equal height, forming a triangle (Civets, Mungooses)..... Viverridæ
   b. Limbs longer.
      a′. Molars $\frac{2}{3}$ (or $\frac{2}{2}$), the upper with well-defined tubercular cusps; lower carnassial compressed, blade-like, with a small inner cusp and a distinct posterior heel (Dogs, Wolves, Foxes)..... Canidæ
      b′. Molars $\frac{1}{1}$, the upper vestigial, without well-defined cusps; lower carnassial blade-like, without inner cusp or posterior heel (Cats)..... Felidæ

Family PROCYONIDÆ

RACCOONS AND THEIR KIN

The raccoons and their relatives are among the least specialized of the Carnivora. They retain all five toes on each foot in a nearly unmodified condition; the hind feet are completely plantigrade, so that in walking the entire sole is applied to the ground. The body is rather plump and short and the tail at least equal to one-half its length. The molars, which do not exceed two above and below on each side, have the four usual cusps in the upper series, and these upper teeth are roughly of equal diameter transversely and longitudinally. There is a tendency for the last upper premolar to become like the first molar in the development of similar cusps.

This family at the present day is typical of the warmer parts of America, and is represented in North America by the Raccoon of the temperate parts, and various arboreal genera in the more tropical areas, such as the coatis (*Nasua*), kinkajous (*Potos*), and the aberrant cacomistles (*Bassariscus*). It is, therefore, especially interesting that there should be a related genus in the Old World, *Ailurus*, which occurs from the Himalayan region of eastern India to the highlands of western China. It perhaps represents a survivor here of a once more numerous and widely spread group of forest-living species.

Pocock (1921a) has advocated the relegation of the genus to a separate family, Ailuridæ, distinct from the American Procyonidæ, but this course has the disadvantage of obscuring the evident affinity between the Asiatic and American genera, and at the same time necessitates the erection of a

separate subfamily for each of the American genera of Procyonidæ, in order to accord as nearly as possible equal consideration of the differences and likenesses. Hollister's course, as being the more conservative and perhaps more illuminating, is here followed.

Genus **Ailurus** F. Cuvier

THE PANDA

Ailurus F. Cuvier, in Geoffroy and Cuvier, Hist. Nat. des Mammifères, vol. 3, pt. 50, pl. and 3 pp. text, 1825.
Arctælurus Gloger, Gemeinn. Hand- u. Hilfsb. Naturg., vol. 1, pp. xxviii, 55, 1841.
Ælurus L. Agassiz, Nomenclator Zool., Index, p. 9, 1846.

The chief diagnostic characters of this genus are set forth by Hollister (1915) as follows: head roundish, ears large, erect, and pointed; tail long and nonprehensile; claws semiretractile; soles of the feet almost entirely haired; os penis small (23 mm. long), not bilobed anteriorly.

"Skull short, high, and rounded . . . zygomata without distinct postorbital processes; sagittal crest well developed. Palate highly arched, grooved medially, and extending only little beyond plane of last molar . . . alisphenoid canal present [absent in other genera of the family]; . . . audital bullæ very small, inflated only on inner side, the external auditory meatus a long and narrow tube. Mandible short, greatly rounded; ascending ramus high, wide, and curved backward; condyles very large."

"Incisors weak. Canine ovate in section at cingulum, grooved on outer and inner surfaces. Each upper premolar with more than one cusp; pm^3 with well developed protocone and hypocone; pm^4 six-cusped, the protocone and hypocone with the prominent supplementary inner cusp forming more than one-half the tooth; pm_1 minute and deciduous; permanent lower premolars all long and narrow. Upper molars usually with numerous accessory cusplets on outside and on the strongly developed inner cingulum shelf; lower molars with numerous accessory cusplets."

The tooth formula is: $i.\frac{3}{3}$ $c.\frac{1}{1}$ $pm.\frac{3}{4}$ $m.\frac{2}{2} = 38$. But a single species is known, with one Chinese race.

156. **Ailurus fulgens styani** Thomas

STYAN'S PANDA

Ailurus fulgens styani Thomas, Ann. Mag. Nat. Hist., ser. 7, vol. 10, p. 251, 1902.
Ailurus refulgens Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, pp. 380, 387, 1868-74 (*lapsus calami*).
Ailurus fulgens Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 3, 1922.
Ailurus styani Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 396, 1922.

Type specimen:—The type is an old male, skin and skull, No. 2.6.10.41, British Museum, collected at Yangliupa, northwestern Szechwan, China, June, 1897, by F. W. Styan.

Description:—In size and form somewhat like a raccoon, but the hind quarters less elevated, the hind legs proportionally shorter. A small eye-patch, and the entire dorsal surface of the body a rusty fulvous to deep chestnut, deepest from the crown to the middle of the back, and becoming less dark red over the lower back and tail. The tail has about nine faintly indicated buffy rings and a short black tip. The muzzle, lips, a submental spot, a spot of larger size over each eye, the cheeks immediately behind the eye-spot,

FIG. 15. Distribution Map.
Ailurus
A. fulgens styani

the inner side and the outer edges of the ears white, the ears with a conspicuous tuft of longer hairs at their outer base; backs of the ears, the fore and hind legs, and the under surface deep black.

There is some variation in the depth of the rufous on the back; in Yunnan specimens as mentioned by Thomas (1922b), and in another from Washin, Szechwan, described by A. B. Howell (1929), the shoulders are heavily blackened, so as to form an almost blackish belt in this region, with the rest of the back a deep ferruginous.

The main peculiarities of the skull have been mentioned under the generic description. The characters distinguishing *A. f. styani* from the typical *A. f. fulgens* of the Himalayan region are said to be the larger size and especially the very much more swollen forehead, obvious in profile, so that the depth measured from the palate to the convexity of the forehead was in the type 46 mm. against 37 for the same measurement in the Himalayan form. The outline of the brain case from above is more swollen and parallel-sided anteriorly, the zygomata stouter and more spreading, and with a better-developed wide ledge at their posterior end above the ear. These distinctions may be partly a matter of age, since none of the Himalayan specimens available to the author of the species was quite so aged, but in a later paper, Thomas (1922b, p. 396) mentions two other specimens since obtained in Yunnan, that confirm the characters given, so that he even goes so far as to regard the Chinese Panda as a distinct species. Nevertheless, the differences are hardly those separating species, and the one is obviously the "representative form" of the other, with the same type of coloring.

Measurements:—The type skin and skull showed the following measurements as recorded by its describer: skin, head and body, 610 mm.; tail, 405; foot, 112; ear, 60.

Skull: greatest length, 115 mm.; basal length, 98; palate from gnathion, 54; zygomatic width, 88; interorbital width, 31; breadth of posterior palate, 13.3; lower jaw, top of coronoid process to lower side of angular process, 55; combined breadth of upper incisors, 15; upper cheek teeth, 37. No other measurements of Chinese specimens are available.

Occurrence and Habits:—The Panda is found in China in only the western highlands, from the higher parts of eastern Szechwan westward in Yunnan to the borders of Burma. In addition to the type from northwestern Szechwan, it has been taken in the mountains near Mau, in the upper Min valley of the northern part of the same province (Jacobi, 1922), and Weigold (1923, p. 72) saw one in the flesh at Wa Shan, but it was held at too high a price for him to purchase. He mentions also two skins brought in from the Wassu region. Zappey secured a skin from this general region, in the Chinchiang valley, but

the skull was unfortunately lost (G. M. Allen, 1912). The American Museum Asiatic Expeditions secured a number of trade skins in Likiang, Yunnan, and Mell (1922) writes that it is one of the commoner furs in the fur market at Talifu in the same province. He believed that most of these came from Weisi. The skins seemed to be little valued, and the tails are used in Talifu and Canton as brushes or dusters. Among fifty trade skins, Mell saw two that were conspicuously white-marked. No doubt the range extends from northeastern Szechwan south to near central Yunnan and thence westward, in the evergreen forests of the high country. According to Prince Henri d'Orléans, it is commoner on the borders of Yunnan and Burma than in the Himalayas (Pousargues, 1896a, p. 2 of separate).

Very little seems to be known of the habits in a wild state, in China. Captive specimens have frequently reached the zoölogical gardens of Europe, chiefly by way of India, and so represent the Himalayan form, whose habits are doubtless much the same. One of the animals was alive in the London Gardens in 1869 and formed the subject of remarks on its habits by the keeper Bartlett (1870) and on the anatomy after its subsequent demise, by W. H. Flower (1870). Other captive specimens have been the subject of brief communications by Trouessart (1922), Sokolowsky (1919), and Lönnberg (1907). Wall (Journ. Bombay Nat. Hist. Soc., 1908, vol. 18, p. 903) writes of a captive animal that gave birth to two young on July 7. Their eyes did not open for nearly a month, August 6 following, and a similar long delay in this respect has been noticed by others. J. Anderson (1869) found them in their actions "wonderfully like raccoons. Every movement is bear-like; they sit up on their hind quarters and strike with their paws in the same way as the bear, climb like the bear, and when irritated make the sudden rush of that animal and emit a nearly similar cry; the bushy barred tail . . . is carried straight out or nearly so. They are very fond of milk, bamboo-leaves, and grass." He found that they liked sugar too. Sokolowsky pointed out that, although believed to be chiefly vegetarian in diet, as indicated by the short cusps and broad crushing surfaces of their molars, as well as by the lack of well-developed carnassial action, they nevertheless appreciate an occasional bird or mouse given them.

Specimens examined:—In all, eight, lacking skulls, namely:

Yunnan: Likiang, 6.

Szechwan: Chinchiang valley, 1 (M.C.Z.); Ketsung, 1 (A.N.S.P.).

Family AILUROPODIDÆ

THE GIANT PANDA

The relationships of the Giant Panda have been the subject of considerable discussion. It was first supposed, by its discoverer, David, to be a new bear,

but Milne-Edwards recognized its position as nearer the Panda (*Ailurus*), though standing in a somewhat intermediate relation, with even a feline appearance in its wide, strong zygomata. He regarded its teeth as less carnivorous in type than those of bears, and suggested a resemblance to the extinct *Arctotherium*. Flower and Lydekker definitely referred the genus to the Ursidæ, and in this they have been followed by most subsequent writers. Pocock (1929), however, after a careful consideration of the external characters, believes it should better stand as a distinct family, intermediate in some respects between the bears and the small panda. In this course, he has been supported by Dr. W. H. Osgood, and this disposition of the genus seems the most satisfactory. The important distinguishing features are, externally: the poorly developed facial vibrissæ as in bears, though the usual tufts are present; the granular-skinned rhinarium with a well-developed philtrum connecting the nose-pad with the upper lip; and the presence of a vertical groove from the margin of the lip nearly to the nostrils, unlike bears; in the feet a web of skin binds the toes together up to the proximal toe-pads; the hind feet are approximately equal in length to the fore; the plantar pad of the fore foot has on its inner border a peculiar lengthwise expansion; metatarsal pads lacking, the posterior plantar pad wide and narrow; tail very short. In the skull the wide and powerful zygomata, high sagittal crest, and short muzzle are striking features, the anterior roots of the zygomatic arches coming off about at the level of the second molar instead of more posteriorly as in the bears; the mesopterygoid fossa extends forward as far as the hind edge of the last molar instead of ending far posterior to that point; the alisphenoid canal is lacking.

In the remarkably broad upper molars with their low cusps, the Giant Panda differs from all its allies. Pocock points out further that in the cusps of the fourth upper premolar, this animal stands quite by itself. This tooth has none of the sectorial character of the carnivores, but is characterized by three outer and two inner cusps, while the third premolar is much like it; the last lower premolar is long and tricuspid, its inner root not fused with the posterior as it is in most bears.

The single genus and species of this family constitute its only known representative.

Genus **Ailuropoda** Milne-Edwards

Ailuropoda Milne-Edwards, Ann. des Sci. Nat., Zool., ser. 5, vol. 13, art. 10, 1 p., 1870.
Ursus David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 5, Bull., p. 13, 1869 (not of Linnæus).
Pandarctos Gervais, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 6, p. 161, footnote, and explanation of pls., 1870.
Ailuropus Milne-Edwards, in David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 92, 1871. Milne-Edwards, Rceherches pour servir à l'Hist. Nat. des Mammifères, p. 321, 1868-74.

The characters distinguishing this remarkable and aberrant genus are mainly given under the discussion of the family affinities. The general bear-

like form and striking coloration of the fur will serve to identify it at once. Of its various characters many are no doubt highly adaptive. As in bears, the nearly equal length of the fore and hind feet is due, according to Pocock, to the shortening of the latter, and may be correlated with the partially arboreal habits; similarly, the broad-crowned molars with their many low cusps and the wide zygomata indicating powerful jaw muscles, are no doubt adaptive modifications, suiting the jaws to handle the bamboo shoots, which form the animal's particular diet. The nature of the foot-pads has been illustrated by Pocock (1929a), and the general characters of the teeth and skull, as well as of the exterior, are beautifully shown in Milne-Edwards's plates. The tooth formula differs from that of bears in lacking the first lower premolar, namely: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{3}$ m.$\frac{2}{3}$ =40. The large size of the anterior premolars in comparison with bears, the lack of a carnassial, and the length and many-cusped nature of the first lower molar are striking features.

Although first described as a bear (*Ursus*), it was at once seen by Milne-Edwards to be of a wholly distinct type, to which he in a preliminary notice gave the name *Ailuropoda*, but later he changed it to *Ailuropus*.

157. **Ailuropoda melanoleucus** (David)

Ursus melanoleucus David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 5, Bull., p. 13, 1869.
Ailuropoda melanoleucus Milne-Edwards, Ann. des Sci. Nat., Zool., ser. 5, vol. 13, art. 10, 1 p., 1870.
Ailuropus melanoleucus Milne-Edwards, in David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 92, 1871. Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 321, pls. 50-56, 1868-74.

Type specimens:—The two original skins and skulls (cotypes) are presumably still in the Muséum d'Histoire Naturelle, at Paris, whither they were sent by Père Armand David, from the principality of Muping in 1869.

Description:—The form is like that of a small bear, stout, with a rounded head and moderate ears. The tail is very short. In color the black and white pattern is very striking, but, as pointed out by Pocock (1921a), not essentially different from that of the Panda, in which a dark eye-mark, black ears and limbs are also found. The ears throughout, a rounded spot encircling each eye, the entire fore leg and shoulder to the spine and the hind leg from about the knee down, are black, the rest of the body and head yellowish white, sometimes washed with brownish or even reddish (Jacobi, 1922). The black of the fore legs extends to the back, forming a black belt, narrower dorsally.

The characters of the skull, with its powerful, spreading zygomatic arches, strong sagittal crest, lack of alisphenoid canal, and generally shortened appearance, have been already described and are well illustrated by Milne-Edwards's plates. The forward extent of the mesopterygoid fossa and the length of the first lower molar are striking points of difference in comparison with the bears.

Measurements:—The type specimen measured some 1,500 mm. in total

length from the muzzle to base of tail, following the curves of the back. The height at the shoulder is given as 660 mm. These figures are doubtless not maximum, for of the skins brought back by the Weigold Expedition (Jacobi, 1922, p. 3), that of the largest male was 1,800 mm., of the next largest 1,610 mm. in length, while that of an adult female was 1,720 mm. Possibly these are to be discounted as from skins that may stretch in preparation.

Of the skull of the type, Milne-Edwards has given (1868-74, p. 337) a detailed list of measurements, in addition to which the only others published seem to be those of two in Jacobi's (1922) paper. The essential measurements of these follow:

CRANIAL MEASUREMENTS OF *AILUROPODA MELANOLEUCUS*

Source	Greatest length	Basal length	Condylobasal length	Length of palate	Zygomatic width	Width of snout between first and third premolars	Across last molars	Upper tooth row, c—m^3	Upper molars+pms.	Length of last upper molar	Lower tooth row, c—m_3
PARIS	290.0	—	—	128	207	—	—	135.0	—	32.0	—
PARIS	265.0	—	—	132	185	—	—	146.0	—	35.0	—
DRESDEN A	—	—	—	—	—	70	—	—	115	—	—
DRESDEN B	288.0	—	256	—	211	61	—	—	110	—	—
9.7.21.3 BM	278.5	237	—	131	206	—	93.8	132.5	—	—	146.2
29678 MCZ	290.0	275	285	—	238	60	91.7	139.0	—	34.5	155.0
ANSP	290.0	243	260	135	203	60	88.0	133.0	116	32.3	—

Occurrence and Habits:—The Giant Panda, since it was first made known to Europeans through its discovery in the high mountains of Muping, central Szechwan, by Père Armand David, has continued to be one of the most elusive of the large mammals of the globe. It appears to be confined exclusively to the bamboo forests of the high mountains in central and western Szechwan, north to the range of mountains forming the boundary between that province and Kansu. David's hunters were successful in procuring for him an adult and a younger specimen, whose skins and skulls are described in much detail by Milne-Edwards (1868-74). According to his informants, it inhabits only the most inaccessible mountains, never coming down into the lower country, and subsists chiefly on roots of bamboo and other plants. Following its discovery in 1869, nothing more was heard of the species until 1892, when Buechner reported it among the specimens brought back by the Russian explorer Berezovski from northern Szechwan. Coming into its habitat from the north, Berezovski reports that it is unknown to the people along the Ssigu River, nor is it found in the Tan Shan, Kansu, but is first met with in the mountain range

forming the boundary between Kansu and Szechwan, which thus makes its northern and western limit. The expedition secured a beautiful skin here from native hunters, who state that it keeps preferably to the bamboo thickets at from 10,000 to 12,000 feet, and that its chief food is the bamboo. The natives declare that it does not hibernate and that if pursued by dogs it may take to a tree. The Chinese name for it is "pei-hsiung" (White Bear) or "hua-hsiung" (Speckled Bear). Of several specimens secured by Berezovski and Potanin, one eventually found its way to the British Museum and another to the Tring Museum, while the others were said to be at the Irkutsk Museum. The British Museum also secured a second specimen, a male, captured by F. W. Styan's native hunters at Yangliupa, northwestern Szechwan (De Winton and Styan, 1899). The British Museum's two specimens are mounted, but later a flat skin was received from the widow of J. W. Brooke, who had purchased it in Szechwan, and Lydekker (1910, p. 987) mentions one "lately" sent from Szechwan by W. N. Fergusson. It was on these specimens that Pocock (1929a) based his studies. Bardenfleth (1914) had published on its affinities some years earlier. Père Heude also (1894b, p. 243) mentions "un bel exemple" given him by Bishop Pinchon, who obtained it in western Szech-

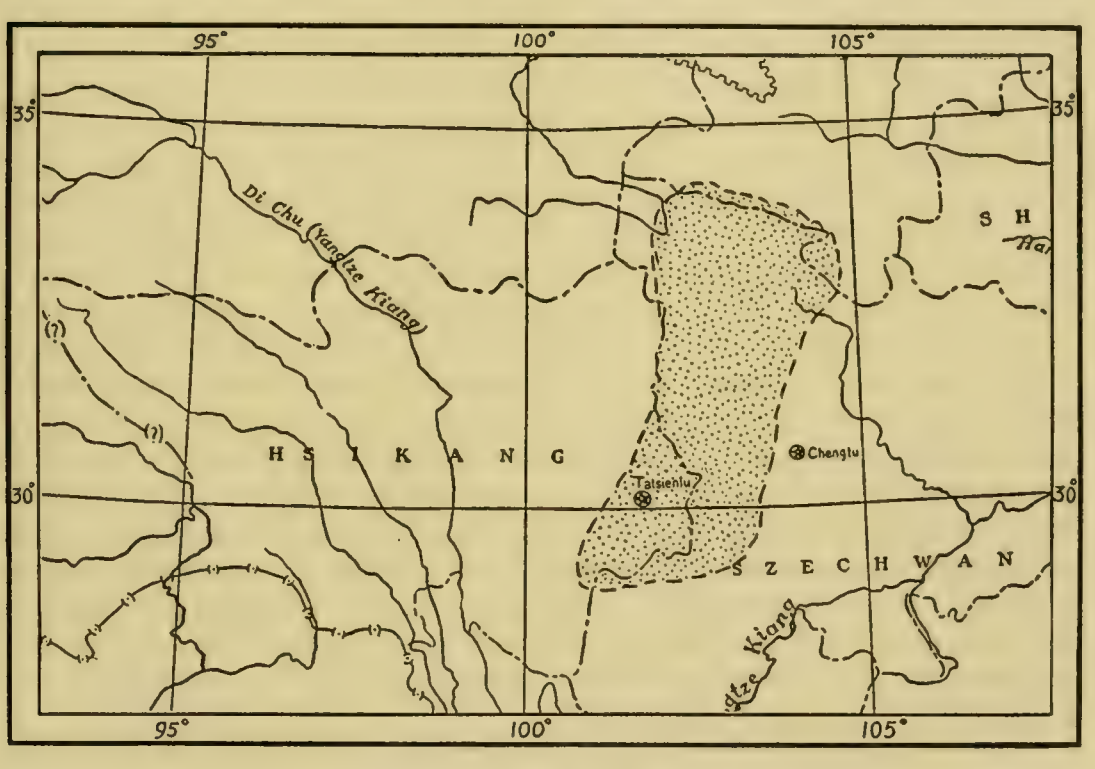

FIG. 16. Distribution Map.
Ailuropoda
A. melanoleucus

wan. Perhaps the first European to see the animal in life was J. H. Edgar, whose letter to Sowerby the latter quotes (Sowerby, 1924e). Edgar in 1903 had received a credible report of a Giant Panda seen in Takiu, on the upper Tung River, opposite the classic country of Muping. In 1916, half-way between Batang and Derze, in wild country not far from Kinsha, Edgar himself saw a large white animal curled up in a great ball, asleep in the forks of a high oak tree. He was unarmed and approached no nearer than about one hundred yards. Sowerby believes that the animal could have been none other than the Giant Panda. In a later communication, Edgar (1929) states that Herbert Stevens, in 1929, saw a family consisting of an adult pair with a cub. He adds (Edgar, 1930) that in ancient times this animal was included in the tribute of Yü, from Liangchow, Szechwan, more than four thousand years ago. To this day the skins are said sometimes to be used as rugs in China, for E. H. Wilson (1913, vol. 2, p. 183) speaks of seeing several fine examples in the possession of Europeans at Chengtu, Szechwan. The skins are occasionally offered for sale in that city and command a high price. When Wilson and Zappey were in the vicinity of Wawushan and southwest of Tatsienlu, west-central Szechwan, they saw "evident signs" of the animal. It is in general solitary and makes beaten tracks through the forest, "frequenting the same haunts for long periods, as is evident from the large heaps of its dung which are often met with in the Bamboo jungle." According to information from the natives, Wilson states that the "pei hsiung" hibernates "for the six or seven months in hollow trees, rocky hollows, and caves," a statement which is contrary to the testimony reported by others. Wilson says further that the range extends from the "vicinity of Wa shan westwards to the forests beyond Tachienlu, northwards to Sungpan, and thence eastwards . . . to the vicinity of Lungan Fu. It is essentially a denizen of the Bamboo jungles between 6,000 and 11,000 feet, feeding on the young shoots of these plants. The natives declare that it eats nothing else . . . Throughout the large area encompassed within the above boundaries, Bamboo jungles are a characteristic feature, forming well-marked zones. In the sparsely timbered belts and in open Silver Fir forests, Bamboo forms absolutely impenetrable thickets. The culms are slender and grow some 10 to 12 feet tall. These plants are impatient of shade from above and grow so thickly together as to starve out all undergrowth and rival shrubs. The young shoots which continue to spring up from June to end of September, according to altitude and species, are white within and excellent eating. The Giant Panda shows good taste in confining his diet mainly to this excellent vegetable!"

Dr. Hugo Weigold, who hunted this animal in central Szechwan in 1916, writes (1923) that in the Sifan region he followed it in the same impenetrable bamboo thickets, which often are compacted by the winter's snows, so that

the trails followed run tunnel-like through them and vary in height from one and a half to five meters. They are used by other large mammals as well, the Black Bear, Leopard, Takin and Wild Pigs. Its food seems to be exclusively the bamboo sprouts, not only the young shoots but also the larger ones as thick as a man's finger. He contradicts the testimony of the natives as quoted by Wilson, for the local hunters do not believe that it hibernates, since they find fresh droppings on the snow, and he himself saw similar signs in early January. The composition of these is exclusively of bamboo fibers, often an inch long, thoroughly crushed. In conversation, Dr. Weigold told me that the native method of hunting is to set dogs on a fresh trail, and then to follow as fast as possible, without a halt, until the animal is overtaken and a shot obtained. He had on several occasions accompanied the hunters, and though an athletic person, found the chase a most arduous one, up and down over the roughest country and through tunnel-like trails in the dense thickets, a pursuit calling for long and strenuous exertion. In much hunting, the nearest he had come to a sight of the game was the appearance of waving bushes as they closed behind a fleeing animal on the opposite side of a small opening. The only living specimen seen was a suckling brought in by the native hunters, but it was later killed. Notwithstanding his lack of success in personally seeing the Giant Panda, Weigold secured several specimens which are listed by Jacobi (1922, p. 3) as follows: (a) an adult male, Wassu Mountains, skin and fore part of the skull; (b) an adult male from the mountains east of the Min valley, skin and complete skull; (c) an adult male from the Wassu Mountains, purchased, with the tip of the skull; (d) a skin only, from the mountains near Min; (e) an adult female in thick winter pelage, with skull, slightly injured at the occiput; (f) an immature skin from the mountains east of the Min valley. Both these last had the white of the back strongly tinged with reddish.

Apparently the first white hunter to secure a specimen is Col. Theodore Roosevelt, who, with his brother Kermit, came upon the track of one in the snow, followed it up, and finally overtook and shot the animal. This specimen and a second obtained from the local hunters, now form a splendid group in the Field Museum of Natural History at Chicago. A brief account of this was published with a photographic illustration by Osgood (1931), and the Roosevelt brothers have also, in their book (1929) describing their journey, given an interesting picture of the experience. In a briefer account, Kermit Roosevelt (1930) tells of the habits and recounts their successful hunt, in which the specimen was secured at a place in the Lolo country, near Yehli, some two hundred miles northwest of Ningyuan (not far distant from Tatsienlu).

All these accounts agree in limiting the distribution of the species to the

central parts of Szechwan, at high altitudes in the bamboo forest. The balance of evidence is against its hibernating; but it apparently lives throughout the year on bamboo shoots which its powerful jaws and broad, flattened teeth are admirably adapted for crushing. It is altogether one of the rarest and most interesting of the larger carnivores, although now represented in most of the larger museums. Quite recently, the Brooke Dolan Expedition secured three for the Academy of Natural Sciences at Philadelphia, to form an exhibition group, and there is a mounted specimen in the new public museum at Shanghai. Again, in the latter part of 1934, an expedition led by Mr. and Mrs. Dean Sage, Jr., shot a fine specimen for the American Museum of Natural History, and were able to preserve not only the skin and skeleton but portions of the soft parts as well, so that ere long the anatomy should be better known. They hunted in an area west of Tsochow on the Min River, Szechwan. [Since the foregoing account was written, a paper on the soft parts of this specimen has been published by H. C. Raven (1936), in which he shows that they resemble the corresponding structures of the Small Panda (*Ailurus*) rather than those of bears. In addition, W. G. Sheldon (1937), a member of the Sages' expedition, has published a brief account of its habits as gathered from his hunting experiences.]

Specimens examined:—In addition to two mounted specimens in the Field Museum, two mounted and one skull (Min River) in the British Museum, and one mounted in the Tring Museum, all from Szechwan, I have more particularly examined a skin and skull from Hotzegou, and another from west of Chengtu, Szechwan (M.C.Z.), and a skull in the museum of the Academy of Natural Sciences of Philadelphia.

Family URSIDÆ

BEARS

With the elimination of the Giant Panda from the bear family, the group is a fairly homogeneous one, characterized externally by the stocky form, very short tail, the rather lengthened muzzle, and the presence of five strongly clawed digits on each foot. The hind feet are plantigrade, the fore and hind limbs both rather short and stout. In the skeleton, the bones of the forearm are free as are those of the lower hind leg, and there is considerable power of rotation in the forearm. The teeth, especially the posterior ones, are modified for crushing by their broad and nearly flat crowns in which the cusps are without cutting edges. There is no specialization of the last upper premolar and first lower molar as sectorial teeth.

This family is rather typical of the Palæarctic region, with an aberrant member in the Andes of South America, and one or two others as the Sun Bear (*Melursus*) and the little Malayan Bear (*Helarctos*) in the tropics of

southern Asia. They are rather variable in the skull characters, according to age, sex, and individual, these differences often being noticeable in specimens from the same region, and due perhaps to individual peculiarities in growth. There has been a recent tendency to exaggerate these and to recognize as distinct species, animals that in life would not be distinguishable by characters of an obvious nature. Bears are animals that can travel far and readily, so that it seems unreasonable to believe that they break up into very local races in small areas. No doubt it will be long before a general agreement is reached as to the generic and specific limits of the described forms, but a conservative treatment is here adopted, and only four different species of bears are recognized as occurring within the limits of China and Mongolia. These represent three genera which may be known from the following key:

KEY TO THE GENERA OF CHINESE AND MONGOLIAN URSIDÆ

A. Muzzle lengthened, the length of the nasals exceeding the width across the first upper molars, size largest ..... *Ursus*

B. Muzzle shortened, the length of nasals about equal to the width across the first upper molars.

a. Size larger, upper and lower premolars $\frac{4}{4}$ ..... *Euarctos*

b. Size smaller, upper and lower premolars $\frac{3}{3}$ ..... *Helarctos*

Genus **Ursus** Linnæus

BROWN BEARS

Ursus Linnæus, Syst. Nat., ed. 10, vol. 1, p. 47, 1758.

The genus *Ursus*, as nowadays restricted, includes the Brown Bears of Europe and Asia (type species, the European Brown Bear, *Ursus arctos*), and the North American Brown and Grizzly Bears. These are large species, either brown or black, with the carpal area behind the palmar pad thickly haired, the carpal pads separate from the palmar, and represented by a single rounded eminence on the outer, and sometimes by a smaller one on the inner side as well. The muzzle is relatively long, with long nasals, whose median length exceeds the width across the front of the first upper molars. The teeth are large, the last upper molar without so decided an indentation on the outer side marking off a posterior heel as in the genus *Euarctos*, but instead with a broadly rounded termination. The cusps are higher and the surface grooves or wrinkles more deeply incised. In the lower jaw, the first molar differs in that the two posterior cones, the hypoconid and entoconid are practically in the same transverse plane instead of being distinctly oblique as in the genus *Euarctos*. Moreover, there is a secondary cusp present between the entoconid and the metaconid, not found in the latter genus, more or less occupying the depression between these two cusps. While the division of the large bears into subgroups is still in a somewhat unsatisfactory state on account of the

lack of proper material, Lönnberg has lately (1923b, p. 91) proposed to regard the large-toothed *U. pruinosus*, with the digital pads united by narrow areas of hairless skin to the palmar and plantar pads respectively, as the type of a new subgenus *Mylarctos*. At least two species of *Ursus* occur within the Chinese and Mongolian areas, but to what extent local races are recognizable or whether more than two distinct species are represented, are questions that will have to await further study with adequate material.

KEY TO THE CHINESE AND MONGOLIAN SPECIES OF *Ursus*

A. Last upper molar about 37 mm. long, color black..... *Ursus arctos lasiotus* Gray
B. Last upper molar about 40 mm., color brown to black, with usually a white collar..... *Ursus pruinosus* Blyth

158. **Ursus pruinosus** Blyth

Ursus pruinosus Blyth, Journ. Asiatic Soc. Bengal, vol. 22, p. 589, 1858. Lönnberg, Proc. Zool. Soc. London, 1923, p. 85.
Ursus lagomyiarius Severtzov, Cat. Zool. Coll. Przewalski, p. 9, 1887. Weigold, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 2, p. 71, 1923.
Ursus arctos collaris Lydekker, Proc. Zool. Soc. London, 1897, p. 421.
Ursus collaris Sowerby, Journ. Mammalogy, vol. 1, p. 224, 1920.
Ursus (Mylarctos) pruinosus Lönnberg, Proc. Zool. Soc. London, 1923, p. 91.
Ursus leuconyx A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 22, 1929.
Ursus arctos pruinosus Pocock, Journ. Bombay Nat. Hist. Soc., vol. 35, p. 807, 1932.

Type specimen:—The type locality is Lhasa, Tibet, and the type specimen is presumably in the Indian Museum at Calcutta.

Description:—A careful description of a bear of this species from the Min Shan, southwestern Kansu, is given by Lönnberg (1897) as follows: snout pale yellowish gray, with a dark brown area around and below the eye; forehead and sides of head rather rich buff, bases of the hairs blackish brown; occiput more cinnamon rufous. Ears clothed with long shaggy fur, blackish brown. A broad white band extends across the chest, and is continued upward in front of the shoulders, on each side, to form a collar around the neck; a branch also extends backward across the upper part of the shoulders, nearly cutting off a large oval patch of blackish yellow-tipped hair. Fore and hind limbs black. Back and flanks black, more or less tipped with yellowish.

In the skull, the nasals are long, their posterior ends extending back "much beyond the frontal processes of the maxillary," their mesial length greater than that of the mesial frontal suture. Teeth very large, especially the molars, which exceed those of the *U. arctos* group. The cingulum is well marked in the upper molars on both inner and outer sides. The greatest length of the last upper molar is 41 mm. in the above specimen. The combined length of the last three upper teeth is more than half the mastoid breadth. The lower teeth are equally large, the combined length of the last four (pm_4-m_3) considerably greater than half the length of the palate (less in males of the *U. arctos* group). As a consequence of the great size of the teeth, and the

resulting length of the tooth row, the posterior part of the last lower molar is obscured from view by the coronoid process in profile, whereas in the *U. arctos* group it is wholly visible.

Measurements:—The following external measurements of a male shot in the Min Shan Range, western Kansu, by George Fenwick Owen, are published by Wallace (1913, p. 295) (the English inches converted to metric units): length from nose to tip of tail in a straight line, 1,550 mm.; height at shoulder, 1,020; height at hind quarters, 915; girth behind shoulder, 810; length of ear, 113; approximate total weight, 242½ pounds. The following skull measurements are in part from Lönnberg's paper, and concern an adult skull from Tibet and a much younger one from Kansu, as well as two others in the British Museum from Kansu.

CRANIAL MEASUREMENTS OF *URSUS PRUINOSUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Length x width of m^2	Length of nasals	Locality
31.7.14.1 BM	343.5	305	179	178.5	151.0	90.0	126.3	143.7	41.2x22.2	100.8	Kansu
31.7.14.2 BM	339.0	—	172	206.5	145.0	91.5	120.5	137.0	39.2x20.4	94.7	Kansu
LÖNNBERG	351.0	—	169	217.0	157.5	—	—	—	39.0x—	—	Tibet
LÖNNBERG	292.0	—	153	153.0	—	—	—	—	41.0x—	—	Kansu
30644 MCZ	323.0	297	166	179.0	136.0	82.8	120.0	133.0	33.8x17.9	85.7	Tibet

The combined length of pm^4, m^1 and m^2 is 79 mm. in the first of Lönnberg's specimens and 83.2 in the second. The first of the two British Museum specimens is a male with temporal ridges just meeting; the second is an adult female.

Occurrence and Habits:—This bear is distinguished by the large upper molar (m^2), which, as shown by Lönnberg, is about 40 mm. long, exceeding that of the *U. arctos* type. In its color pattern, it usually seems to show some sort of whitish collar as an extension dorsally of the white crescent on the chest. This was the case in Lönnberg's specimens, and in that mentioned by Howell (1929) from Kansu. The photograph reproduced in Wallace's book (1913) on "Big Game of Central and Western China" (facing p. 182) also shows the same character, with the pale mark extended part way down behind the shoulder as well, much as in some Grizzly Bears. I have followed Lönnberg in referring these big-toothed bears to *U. pruinosus*. The latter author has even thought the species worthy of subgeneric rank, and proposed the name *Mylarctos* as mentioned in the discussion of the generic characters. On the other hand, in a recent paper, Pocock (1932a) after careful consideration decides that it is probably a race of *U. arctos*.

Hitherto this bear seems to be known from only the western part of the Chinese highlands, whence it extends westward into the Tibetan plateau. In addition to the Kansu specimens, Weigold mentions, under *Ursus lagomyiarius*, what is apparently the same animal with the white collar, as more especially a species of the steppe country, the "ma hsiung" or Horse Bear of the natives of western China, or the "dry-mu" of the Tibetans (meaning Devil's Grandmother). It is much feared and only occasionally killed with the old-fashioned flint-locks these people possess. Weigold says further that it is reported to occur in the Miniak region, some days' travel southwest of Tatsienlu and about Batang, where he was given a cub, which he succeeded after much trouble in transporting alive to Peiping. Probably it was this species that Filchner (see Matschie, 1908, p. 138) met with in the Koko Nor region, a long-haired, silvery bear that was said to dig out and feed upon small rodents, just as our Grizzly Bear does. No definite records are at hand for its presence to the north or west of the Gobi, but Noack (1905, p. 748) has briefly described, without venturing to name, three skins of bears with silvery heads and white claws from Kobdo, in northwestern Mongolia.

Specimens examined:—Two from the Min Shan, western Kansu (B.M.).

159. **Ursus arctos lasiotus** Gray

LARGE BLACK BEAR; BLACK GRIZZLY

Ursus lasiotus Gray, Ann. Mag. Nat. Hist., ser. 3, vol. 20, p. 301, 1867. Lönnberg, Proc. Zool. Soc. London, 1923, p. 91.
Ursus piscator Sclater, Proc. Zool. Soc. London, 1867, p. 818.
Ursus torquatus macneilli Lydekker, Proc. Zool. Soc. London, 1909, p. 609, text figs. 186, 187, B.
Selenarctos macneilli Sowerby, Journ. Mammalogy, vol. 1, p. 220, 1920.

Type specimen:—The specimen on which this species was founded was sent alive to the Zoölogical Society's Gardens in London, about 1867, where it attracted the attention of Gray. His description is based on the external appearance only. The skin and skull are preserved in the British Museum, No. 93.9.10.1. The animal was said to have been received from "Northern China, and was stated to come from the interior of that country" (Sclater).

Description:—In his original description, Gray writes that this bear belongs to the same group as the European Bear, has a "broad head rounded above behind, a moderate broad nose, and prominent ears," but differs in having the latter covered externally and especially internally with long soft hairs, which form a tuft filling up and projecting beyond the ear cavity; the fur also is longer and there is a large tuft of long hair on the throat projecting forward. Its color is black like the Japanese Bear, but it lacks any white chest mark; the nose is brownish.

The skull is large, with long and rather tapering rostrum, and long nasals

whose median length considerably exceeds the width outside the first molars. The teeth, though larger than those of *Euarctos thibetanus*, nevertheless are smaller than those of *Ursus pruinosus*, and agree with the latter in the possession of the extra cusp on the inner side of the first lower molar and in the position of the posterior pair of cusps.

Measurements:—Through the kindness of Mr. R. I. Pocock, I have the measurements of the type skull of this bear, and have added those given by Lönnberg (1923b) for the skull of an adult male from northern Mongolia.

CRANIAL MEASUREMENTS OF *URSUS ARCTOS LASIOTUS*

Locality	Greatest length	Condylobasal length	Palatal length	Length of nasals	Zygomatic width	Mastoid width	Width between last molars	Combined length, pm^4, m^1, m^2	Last upper molar	Width outside m^1
"N. CHINA" (type)	408	378	198	—	245	202	52.0	78	37.0x20.0	90
MONGOLIA	387	—	188	117	218	—	48.3	75	35.3x18.5	82.5
TATSIENLU (type of *U. macneilli*)	—	—	—	—	258	—	—	66	33.0x18.0	—

Nomenclature:—Lönnberg is doubtless correct in assigning Gray's name *U. lasiotus* to the larger black bear that occurs in western China and Mongolia. While from time to time various names have been applied to these and other eastern bears, very little critical work with comparable specimens has been done to see if more than one race is represented, but instead "new" forms have been named on very slight basis, and so inadequately described that it is difficult to tell what animal is meant or what the real characters are. Sowerby (1920a) regards *U. lasiotus* as unidentifiable, but since the type is still in the British Museum, this should hardly be the case. Lönnberg has shown that this large black bear is to be considered distinct from the paler Kamchatkan bears, *U. piscator*, while Sowerby has even urged its generic distinctness, on the ground of the long narrow skull with high forehead, assigning to it the name *Spelæus* Brookes. Heude (1901) erected the new genus *Melanarctos* for what is apparently a bear of the same type from Manchuria. Sowerby has given a good description of one of these bears, under Heude's specific name *M. cavifrons*, shot at a locality in northern Kirin, a very large specimen, the skull of which was 16 inches long (404 mm.). The animal was estimated to weigh 600 pounds. I would refer to the same species the bear named by Lydekker (1909b) *Ursus torquatus macneilli*, on the basis of a skin and skull from the mountains of Szechwan, regarded by him as part of Tibet. The

description is somewhat unfortunate, in that the letters designating the skulls are transposed and the comparative notes refer to the wrong skulls. The skull as shown with two of the *Euarctos* type, is long and slender, while the figures of the teeth have unequivocally the extra cusp in the inner valley of m_1 and the two posterior cusps in the same transverse row. The large size of the teeth as compared with *Euarctos thibetanus*, the broad rounded heel of the upper posterior molar, and the narrowness of the muzzle across the first upper molar, all go to show that instead of being a large male of the *E. thibetanus* type, this specimen was an immature of the *U. lasiotus* group, in which the basal suture is still widely open. No doubt Lydekker was misled by the close similarity in the black pelt with brown nose, although he especially mentions that the skin "which is in winter coat, differs from that of any Himalayan specimens of *U. torquatus* that have since come under my notice—and I have handled a good many—by the greater length and softness of the hair." [Since the foregoing note was written, Pocock (1932a) has independently reached the same conclusion, that *U. lasiotus* is a race of *U. arctos*. He, however, states that *Ursus macneilli* is a synonym of *E. thibetanus mupinensis*, a conclusion somewhat different from my own, but possibly the correct one.]

Occurrence and Habits:—This larger black bear no doubt once had a wider range than now, probably over much of the wooded part of North China to Szechwan. Gray's specimen, taken about sixty-five years ago in northern China, may well have come from somewhere in Hopei; and the specimen described by Lydekker as *U. t. macneilli* may represent nearly the southward bounds of the present-day range, some distance to the westward of Tatsienlu, Szechwan. Sowerby has hunted what is doubtless the same animal in northern Manchuria, while to the north of the Gobi, Lönnberg records a more recent specimen from "Northern Mongolia." Perhaps this is the "Horse Bear" of Chinese literature and tradition. Sowerby says that it is fiercer in disposition than the smaller black bear, and prone to attack a man at sight. He even relates an instance in which a hunter was killed and partly devoured by a bear of what he regards as "*Spelæus cavifrons*," but which may really be only this same species occurring in the Manchurian forests.

Specimens examined:—One (B. M., the type), from "North China."

Genus **Euarctos** Gray

Euarctos Gray, Proc. Zool. Soc. London, 1864, p. 692 (as subgenus of *Ursus*). Merriam, Proc. Biol. Soc. Washington, vol. 10, p. 65, 1896 (as subgenus of *Ursus*). Pocock, Ann. Mag. Nat. Hist., ser. 9, vol. 1, p. 384, 1918 (as a genus).
Ursus Linnæus, Syst. Nat., ed. 10, vol. 1, p. 47, 1758 (in part).
Selenarctos Heude, Mém. concern. l'Hist. Nat. de l'Emp. Chin., vol. 5, pt. 1, p. 2, 1901.
Tremarctos Pocock, Proc. Zool. Soc. London, 1914, p. 932 (in part).
Arcticonus Pocock, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 129, 1917.

There has been much confusion in regard to the characters and species

of the Black Bear groups of Asia and America. Gray was apparently the first to subdivide the genus *Ursus* into subgenera, and in 1864 erected for the American Black Bears the subgenus *Euarctos*, type *Ursus americanus*, briefly characterizing the group as follows: "Fur short, uniform. Front claws moderate, not much longer than the hind ones. Hind feet short. Upper tubercular moderately long, narrowed behind." These characters Merriam (1896) further elaborated in his preliminary synopsis of American bears, by pointing out the more important differences in the teeth, namely: (1) the form of the first lower molar (m_1) in which there is "a broad, open, flat space or step on the inner side between the middle and posterior cusps (metaconid and entoconid), which is never present in the Brown and Grizzly bears," in which this notch is occupied by one or more smaller cusps; (2) the posterior cusps (hypoconid and entoconid) of this tooth "are nearly opposite," *i. e.*, in the same transverse plane, in the Grizzlies and "very oblique" in the Black Bears; (3) the last lower premolar (pm_4) lacks any accessory cusps on its inner side, lacks any median sulcus on its posterior face, has no "inner limiting ridge, and is uniformly much smaller"; (4) the last upper premolar (pm^4) lacks all trace of a posterior accessory cusp; and (5) the last upper molar (m^2) is abruptly narrowed on the outer side behind the second outer cusp. In 1901, Père Heude again took up the matter of dividing the genus *Ursus*, and proposed for the Asiatic Black Bears related to *U. thibetanus*, the generic title *Selenarctos*, of which he at the same time named two additional "species." Sowerby (1920a) formally designated as the type of this genus, *Ursus thibetanus*. Meanwhile, Pocock (1914), approaching the subject from the point of view of the external characters, divided the bears into five genera, and included in the genus *Tremarctos*, the Asiatic Black Bears and the Spectacled Bear of the South American Andes, and placed the *Euarctos* group in *Ursus*. Three years later, however, he receded from this position and erected the genus *Arcticonus* for *Ursus thibetanus*, the chief characters of which are said to be that the area between the digital and palmar pads is overgrown with hair except behind digits 1 and 5, where the naked area is continuous with the palmar pad and the latter itself is confluent with the carpal pad by means of an area of thinner hairless skin. He states that *Euarctos* has the essential characters of rhinarium, lips and ears as in *Arcticonus*, though the ears are smaller, while the feet in the former are less specialized in having the carpal pad small and separate from the palmar, and the deep hairy indentation in the plantar pad of the hind foot is more marked. I have carefully compared specimens of the American Black Bear with those of the *E. thibetanus* group and find that the supposed nakedness of the skin connecting the palmar pad with the digital pads of the first and fifth digits does not hold, for the usual condition in both bears is to have the bases of all the fingers haired. The absolute identity of the tooth structure

in the two as compared with the Brown and Grizzly Bears leaves only the matter of size differences and the more advanced state of the development of the pads for specific characters. The confluence of the carpal and palmar pads in the *E. thibetanus* group and their separateness in the American Black Bear, may indicate that the former is in a more advanced condition of development and that the American species is more primitive; or possibly the larger size of the pad, through the confluence of these two elements, is in part a result of the greater size and weight of the Asiatic species, tending to the development of a larger area of support with more ground-living habits. Another point in which the Asiatic Black Bear resembles the American, and differs from the Brown and Grizzly groups, is in the shortened muzzle. This character, which has not apparently been emphasized heretofore, is well brought out by measuring the median length of the nasal bones and comparing this distance with the width across the outer sides of the first upper molars. In the American Black Bear and the Asiatic *E. thibetanus*, the distance from the anterior end of the nasals to their posterior median termination is about equal to the width outside the front end of the first upper molars, whereas in the Brown and Grizzly Bears the nasal length is much greater than this distance, indicating a relatively longer and narrower rostrum, a difference that may not always strike the unaided eye, on account of the difference in size and zygomatic width in bears of different ages. This short-snouted character will, however, serve to separate the two groups easily, so far as the series of skulls I have examined may show.

Since there is, therefore, perfect resemblance in every important detail of tooth structure and of external appearance, except in the greater development of the palmar pad in the Asiatic species, I cannot see any course but to regard the bears of the *thibetanus* group as congeneric with *Euarctos*. To place them in different genera is to rely on characters that separate them specifically only, as well as to obscure very obvious relationships that are of value in tracing the derivation of the faunal elements of northern Asia and North America. It is, therefore, clear that *Euarctos* should include as well the Asiatic species, *E. thibetanus*. No doubt a considerable amount of confusion has resulted from the fact that Asia is likewise the home of other black bears of the typical genus *Ursus*, but these, although superficially like the *Euarctos* group, may be recognized easily by the tooth characters as well as by the fact that the nasal length much exceeds the width across the front of the first upper molars.

It is still a question how many recognizable races of this bear occur in China. Of those described, the characters given for most do not seem to be distinctive, and so far as the specimens I have seen go, there are no good grounds for recognizing more than the two races here described.

160. **Euarctos thibetanus thibetanus** (G. Cuvier)

TIBETAN BLACK BEAR

Ursus thibetanus G. Cuvier, Ossemens Foss., vol. 4, p. 325, 1823.
Ursus tibetanus F. Cuvier, in Geoffroy and Cuvier, Hist. Nat. des Mammifères, vol. 3, pt. 41, pl. and 2 pp. text, 1824. Swinhoe, Proc. Zool. Soc. London, 1870, p. 621.
Ursus torquatus Wagner, in Schreber, Säugthiere, Suppl., vol. 2, p. 144, pl. 141D, 1841. Lydekker, Proc. Zool. Soc. London, 1909, p. 610.
Selenarctos mupinensis Heude, Mém. concern. l'Hist. Nat. de l'Emp. Chin., vol. 5, pt. 1, p. 2, 1901. Sowerby, Journ. Mammalogy, vol. 1, p. 219, 1920.
Selenarctos leuconyx Heude, Mém. concern. l'Hist. Nat. de l'Emp. Chin., vol. 5, pt. 1, p. 2, 1901.
Ursus thibetanus macneilli G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 239, 1912 (not *Ursus macneilli* Lydekker).
Tremarctos thibetanus Pocock, Proc. Zool. Soc. London, 1914, p. 932.
Arcticonus thibetanus Pocock, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 129, 1917.
Selenarctos thibetanus Sowerby, Journ. Mammalogy, vol. 1, p. 218, 1920.
Ursus clarki Sowerby, *ibid.*, p. 226 (based on *Selenarctos leuconyx* Heude).
Selenarctos thibetanus wulsini A. B. Howell, Proc. Biol. Soc. Washington, vol. 41, p. 115, 1928.
Selenarctos thibetanus mupinensis A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 21, 1929. Pocock, Journ. Bombay Nat. Hist. Soc., vol. 36, p. 121, 1932.
Selenarctos thibetanus thibetanus Pocock, *ibid.*, p. 111.

Type specimen:—The name *Ursus thibetanus* is based on the quoted account of a Black Bear of intermediate size between the small *Helarctos malayanus* and the Sloth Bear, transmitted to the Cuviers by Duvaucel, who states that it was first found by Wallich in Nepal, and later by Duvaucel himself in Sylhet. This bear was figured by F. Cuvier in livraison 41 of the "Mammifères" bearing date May, 1824, under the title "Ours du Thibet," but the name was published by his brother Georges the year before. The type locality may then be taken as Nepal, at that time regarded as an outlying portion of the Tibetan country. There is, therefore, no type specimen as such.

Description:—Hair of neck and shoulders longer than on body, forming a sort of ruff. In the fore feet the carpal pad is broadly united with the palmar, the digital pads separated from the latter by hairy areas; in the hind feet there is no hairy reëntrant on the inner side of the plantar pad which broadly covers the sole behind the digits. Color of the upper lip and muzzle about as far back as the eyes, dull tan; a prominent white crescentic mark of variable extent on the fore part of the chest, and a variable amount of white at the chin; sometimes a tuft of whitish hair on the feet at the front edge of the main pad. Elsewhere shining black.

The skull of the Himalayan Black Bear is readily distinguished from that of other Asiatic bears by the shortened rostrum, so that the length of nasals taken with dividers on the median line is practically the same as the width across the outer sides of the first upper molars, at their front end. The skull differs from that of the American Black Bear in that the occipital part is slightly more developed with heavier paroccipital processes. If the alveolar line from canine to last upper molar is projected backward, it cuts the upper

edge of the glenoid cavity and the middle of the paroccipital process, whereas in the American species it passes through the middle of the glenoid fossa and usually falls below the level of the latter process. The peculiarities of the tooth structure distinguishing these bears have been mentioned under generic characters.

Measurements:—No flesh measurements or records of weight are at present available for Chinese bears known to be of this species.

The cranial dimensions are from specimens in the American Museum representing the bear described as *S. t. "wulsini,"* as well as from others from localities to the west and south.

CRANIAL MEASUREMENTS OF *EUARCTOS THIBETANUS*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Mas-toid width	Width across first upper molars	Length of nasals	Upper tooth row	Lower tooth row	Locality
45292	——	——	150.0	190.0	——	——	——	110.0	126.5	Hopei
45293	248.0	233.0	136.0	145.0	115.0	——	——	94.0	109.0	Hopei
57074	266.0	253.0	147.0	173.0	138.0	66.0	65.0	105.0	——	Hopei
57075	275.0	——	147.0	168.0	136.0	——	——	102.0	117.0	Hopei
57076	258.0	243.0	135.0	170.0	134.0	——	——	98.0	109.0	Hopei
11770 MCZ	——	263.0	150.0	195.0	164.0	67.0	63.0	108.0	120.3	Hupeh
5073 MCZ	289.0	269.0	155.0	210.0?	155.0	71.0	69.0?	104.0	120.5	India
9.7.10.1 BM	274.5	249.0	139.0	175.0	144.0	65.8	60.5	95.0[1]	107.5[1]	Szechwan
96.11.4.1 BM	244.5	218.5	120.5	134.5	117.5	61.0	57.6	90.5[1]	100.5[1]	Szechwan

[1] Front of canine to back of last molar.

Nomenclature:—The name *Ursus torquatus* is sometimes used for this bear, following Blanford, who argued that since it was not known to occur in Tibet, the name *E. thibetanus* was inappropriate, and should be replaced by the later one. This, however, is inadmissible, and at the time the name was given, Tibet was loosely used to include the bordering parts of India and China. The original spelling is with the "h," but this was omitted by F. Cuvier. In 1901, Père Heude, in a brief article on the bears of China, believed he could discriminate four species of black bear related to *E. thibetanus*, occurring in eastern Asia, and gave them new names with figures of the teeth but very meager descriptions. One of these was *Selenarctos mupinensis*, from Muping, Szechwan, believed to be distinguished by the lack of the usual white chin spot, a character that is so variable (as shown by the five skins from one locality in Hopei secured by Dr. R. C. Andrews) that little reliance can be placed upon it. Pocock, however, tentatively admits it as a subspecies. A second "species" Heude named *Selenarctos leuconyx*, based on a skull and the fore paws of a bear from northern Shensi. The claws of these feet were white and the hair surrounding them, as well as that on the under side of the digits, instead of blackish

brown as usual. The figures of the teeth given (Heude, 1901, pl. 2, figs. 3, 4, 8) leave no doubt whatever that they pertain to the *E. thibetanus* type, and since there is in these bears more or less white hair about the base of the toes, it is most likely that the individual in question was more albinistic than usual, which accounts for the saving of its fore paws. Nevertheless, Sowerby (1920a, p. 225), in reviewing Père Heude's work, referred the skull in question to typical *Ursus*, and since *Ursus leuconyx* is preoccupied through its use in 1873 by Severtzov for a large Altai species, he proposed the new name *Ursus clarki*. In 1928, A. B. Howell, acting perhaps on the suggestion of Sowerby that the Black Bear of Hopei would prove to be an undescribed form, named as *Selenarctos thibetanus wulsini* a specimen from the Eastern Tombs, Hopei. After careful comparison of the available material and descriptions, I am, however, unable to find reliable marks of distinction, for the skulls of bears vary so much in certain characters, as "somewhat broader" or in height or convexity of skull, that these cannot be used as criteria. The amount of white on chest or chin, or even on the feet is also inconstant, as often with white markings. Moreover, bears are mammals that travel over a considerable area and probably do not divide into geographical races as readily as do smaller or more sedentary species. Until more reliable differences of a geographic nature are pointed out, it does not seem advisable to recognize more than the one species in China. In his recent review of the bears of Asia, Pocock (1932a) tentatively uses the name *ussuricus* of Heude in a subspecific sense to include the black bear of North China.

Occurrence and Habits:—Speaking broadly, the Himalayan Black Bear extends over the rough wooded country of China from Hopei and Shansi south to perhaps the Yangtze basin and west to the borders of Kansu and Tibet. In southern China, there is evidence that it is represented by a smaller subspecies. No doubt in former times its range was nearly uninterrupted over this wide area, but at the present time, through human occupation and the destruction of forests, it is much restricted. Its presence in the forests of the Tungling region was reported by Sowerby in 1920 and later confirmed by the securing of specimens from there by Dr. R. C. Andrews and Dr. F. R. Wulsin. The same or a closely allied animal is common in parts of Manchuria and Korea (whence the Museum of Comparative Zoölogy has specimens indistinguishable from Chinese examples). With the rapid destruction in recent years of the forests in the old Imperial Hunting Grounds of the Eastern Tombs area, the Hopei bears may ere long be exterminated. Heude has recorded this species from northern Shensi, but Sowerby (1920a, p. 215) has pointed out that the locality whence came the specimen he named *Selenarctos leuconyx* (Paoki or Paochi) is not as he supposed in northern Shensi, but to the west of Sianfu, at the foot of the Taipai Shan, in the Tsingling Range. The specimen is still in the

Sikawei Museum at Shanghai. Dr. R. C. Andrews also secured a specimen here in November, 1921, a subadult female, but quite typical of *E. thibetanus*. This bear also occurs to the south, for W. R. Zappey secured a skull in Hupeh, in 1907-8, that is now in the Museum of Comparative Zoölogy. Bears must be very rare in the more thickly settled parts of North China, but Swinhoe (1870c, p. 621) procured a specimen at Chefoo, Shantung, supposed to have come from that vicinity, and Sowerby (1920a, p. 215) is authority for its presence in Chekiang. It occurs in the mountain forests of southern Kansu, and southward over Szechwan and westward to the borders of Tibet. How far south it may go remains to be shown, but A. B. Howell (1929, p. 21) records the skin and skull of a cub from Suifu, Szechwan, referring it "on geographic grounds" to the supposed subspecies *mupinensis*, and there is a specimen in the British Museum from Mekong valley, Siam. Weigold (1923) writes that on the borders of Tibet, about Batang, in western Szechwan, the people distinguish two kinds of Black Bear, a larger and a smaller. No doubt the latter is the present species, the former a species of true *Ursus* (probably *pruinosus*). He says that they are found everywhere, in the mountain forests, from 1,300 to 3,400 meters altitude, to the upper limit of timber, but not quite so high in the vicinity of Sungpan, where he saw a young one the size of a spitz-dog; a second in Wassu-land; a female in September in the Min valley above Kwanhsien. Others were seen by missionaries near Tatsienlu, again near Batang, in the valley of the upper Yangtze, and in thick forest near Samando. The native method of hunting is with dogs. This bear is said to hibernate, but very little seems to be definitely known of its habits. According to native report (Wallace, 1913, p. 195), mating takes place after coming from hibernation; in western China, they go into winter quarters in September after the first fall of snow, and the young are born, as with the American Black Bear, in winter, the mother on emerging in spring being accompanied by a cub two or three months old.

Specimens examined:—Nine, as follows:

China:

Hopei: Eastern Tombs, 4.
Shensi: base of Taipai Shan, 1.
Hupeh: 1, skull (M.C.Z.).
Szechwan: Lunganfu, 1 (B.M.); loc.? 1 (B.M.).

Siam: Mekong valley, 1 (B.M.).

161. **Euarctos thibetanus melli** (Matschie)

HAINAN BLACK BEAR

Selenarctos melli Matschie, in Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 34, 1922. Mell, *ibid.*, p. 16, pl. 2, fig. 3.

Ursus tibetanus Swinhoe, Proc. Zool. Soc. London, 1870, p. 231 (in part).

Selenarctos thibetanus melli G. M. Allen, Amer. Mus. Novitates, no. 360, p. 3, 1929.

Type specimen:—In the brief description the number of the type is given as 1549, probably the original number in R. Mell's collection. No locality is given by the describer, but, according to Mell's account, the specimen was taken in the Five-finger Mountains (Wuchih) of Hainan, and was said to have been born in March, 1915. Mell acquired it when it was nine months old, and it was killed at the age of three years and eight months. It was a male, now presumably in the Berlin Museum.

Description:—This is apparently a smaller race of the Himalayan Black Bear, but the original diagnosis gives no critical details, beyond the fact that the color is black, and there is the usual white horseshoe mark on the chest. The total length of the skin was 900 mm. I have regarded the South China Black Bear as identical with that of Hainan, and have examined the skin and skull of an old male with teeth much worn and sutures of the skull obliterated, secured in Fukien by Mr. C. H. Pope. This skull is so much smaller than those from northern and western China that it suggests a distinct race, presumably identical with the Hainan Black Bear. The skin, taken in April, is shorter-haired than the winter skins from Hopei.

The skull is characteristic of the group, but is as small as that of an adult female of the typical *E. thibetanus*. Its measurements are given herewith: condylobasal length, 260 mm.; basal length, 243; palatal length, 128; zygomatic width, 176; mastoid width, 133; across front of first molars, 59.5; length of nasals, 58.5; least interorbital width, 71.5; upper tooth row, 97; lower tooth row, 114; last upper molar, 29 by 16.5; vertical width of jugal, 13.

Occurrence and Habits:—As long ago as 1870, Swinhoe (1870a, p. 231) recorded that he was shown in Hainan a shaggy black bear skin said to have been killed on the island. He adds that bears are said to be shot with poisoned arrows by the wild tribes of the mountains, and quotes a few paragraphs from the Hainan Gazetteer on the curious beliefs of the natives as to their sucking their paws, their eating of children, and the supposed seasonal migration of the gall bladder to different parts of the body. "About its heart there is white fat like jade, the taste of which is extremely fine. . . . In winter the bear lies torpid and does not eat." Mell (1922) says of the specimen he had, the one that later formed the type of this race, that it came as a cub from the Five-finger Mountains (Wuchih) of Hainan, and was said to have been born in March, 1915. He acquired it when it was nine months old and kept it alive, during his residence in Canton, for nearly three years. During this time it grew very little, and seemed to be stunted, as a result perhaps of captivity. A photograph shows it tethered by a chain. It is very interesting to find a representative of this northern group on Hainan, but it is in line with the

presence there of a mole (*Mogera hainana*), also a northern type of mammal. A very young black bear cub was secured by Mr. Clifford H. Pope near Namfong, Hainan, as well, thus proving conclusively that the species is still to be found there. On the adjacent mainland, Black Bears cannot be very plentiful. Mell (1922, p. 16) states that the Chinese and the missionaries agree that these bears occur in the mountainous country west of Logdsong, a report which he would have discredited had he not been told by La Touche of a freshly killed black bear being taken through the streets of Foochow. The fine adult male secured by Mr. C. H. Pope at Chunganhsien in Fukien Province further confirms its presence in the wilder parts of southeastern China. Indeed, I have recognized the subspecies on the basis of this specimen, which, in spite of its age, with all cranial sutures obliterated, is yet much smaller than the more northern males, and the fur is less thick. No adult specimen actually killed in Hainan has been examined critically, so that the identity of the island animal with that of the neighboring mainland is conjectural merely, though, judging from the close similarity obtaining in island and mainland individuals of other species, it is very probable that such identity will be confirmed in the case of the bear.

Mr. Pope sends the following note: "Bears are by no means rare about Kuatun, even though they are not often killed. The native hunters declare that each range has its bear. They are frequently guilty of damaging patches of corn and are most often killed by guns or bows and arrows set over night at openings in the bamboo fences constructed around corn patches. Almost undoubtedly bears occur around Yenping but there seems to be no specimen available by way of definite proof. The bear is universally called 'hsiung' in China. Two kinds are generally mentioned, the 'chu hsiung' or pig bear, and the 'kou hsiung' or dog bear. In the minds of most Chinese there is no definite distinction and the names have probably come down through literature. Some of the Kuatun hunters, however, insist that the badger is meant by the latter term. The 'jin hsiung' or man bear is often mentioned along with the others." The specimen Mr. Pope secured in Hainan was brought in by the Loi hunters, who seem to be the only ones to obtain them, for he was unable to find any Chinese who had successfully hunted them in the island.

[Since the above account was prepared, Pocock's excellent review of the Old World bears has appeared. He is doubtful if the bear of South China is really distinct from that of western China and suggests that if the small size proves to be constant, it should be the same as *formosanus* of Formosa. He erroneously gives the type locality of *E. t. melli* as Kwangtung, China.]

Specimens examined:—Two, as follows:

Fukien: Chunganhsien, 1.

Hainan: Namfong, 1 (cub).

Genus **Helarctos** Horsfield

Helarctos Horsfield, Zool. Journ., vol. 2, p. 221, pl. 7, 1825 (as subgenus of *Ursus*). Pocock, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 129, 1917.

Helarctus Gloger, Hand- u. Hilfsbuch Naturgesch., pp. xxviii, 53, 1841.

Ursus of authors (in part).

The great shortening of the snout in this bear is characteristic, resulting in a contraction of the upper tooth row, and the loss of one of the small upper premolars, apparently the second, so that the first is closely applied against the postero-internal base of the canine, with its socket continuous with that of the canine and not separated by a wall of bone (in the specimen available for comparison); the small pm^2 is lost, and pm^3 fills the space between the larger first premolar and the still larger pm^4. A similar loss has taken place in the lower jaw. Canines extremely stout and powerful, with a narrow compressed ridge on their postero-external border. First upper molar nearly square, with its two outer cusps subequal and much higher than the two inner. Last upper molar slightly longer, with a contracted posterior heel. Zygomatic arch wide but the jugal slender; a distinct sagittal crest present in old animals; paroccipital process large, blunt, and produced downward; upper alveolar line if extended backward cuts upper part of glenoid cavity and upper edge of auditory meatus. Carpal pad wide, as in Black Bears, but ear shorter, narrower and simpler, less expanded in upper part, its height from the supratragus to the summit less than the greatest width. Rhinarium extending to the upper lip, its lateral portions projecting beyond and concealing the septum in side view (Pocock, 1917).

The small size, shortened snout, broad zygomata, steeply convex frontal profile, enormous canines, and the reduced tooth formula ($i.\frac{3}{3}$ $c.\frac{1}{1}$ $pm.\frac{3}{3}$ $m.\frac{2}{3} = 38$) are distinctive of this well-marked genus, as well as the characters of the rhinarium pointed out by Pocock. It is peculiar also in its tropical habitat. A single species inhabits southeastern Asia, perhaps barely reaching southern Yunnan.

162. **Helarctos malayanus wardi** (Lydekker)

BRUANG

Ursus malayanus wardi Lydekker, Proc. Zool. Soc. London, for 1906, p. 997, text fig., 1907.

Helarctos malayanus Pocock, Journ. Bombay Nat. Hist. Soc., vol. 36, p. 132, 1932.

Type specimen:—The type is specifically stated by Lydekker to be the skull described and figured by him in the place above mentioned. The specimen was received from Rowland Ward, Ltd., of London, but no precise locality was given. Presumably it came from southwestern Yunnan or Szechwan. It is No. 6.12.16.1, British Museum.

Description:—The distinguishing character of this race of the Bruang is said to be its much longer hair than that of the Malayan animal. The skin of a specimen from the same source was said to be wholly black, except for the nose, which is ferruginous, the chin, which is grayish white, and the usual patch at the throat of a cream color. There is a possibility that the skin was, however, not of the same specimen as the first of Lydekker's two skulls.

The skull is said to be quite indistinguishable from that of the typical form.

Measurements:—The measurements of the type skull are: greatest length, 255.8 mm.; basal length, 220.5; palatal length, 127; zygomatic width, 201; mastoid width, 171; width outside molars, 71.8; upper cheek teeth, 85.3; lower cheek teeth, 99.

Occurrence and Habits:—The inclusion of this species in the Chinese fauna rests perhaps upon somewhat insecure grounds. Lydekker in his original account says that about 1905 a skull of a Bruang was received by the British Museum from Rowland Ward, Ltd., of London, from some locality in eastern Tibet or the northwestern provinces of China and that the skin of this specimen had been mounted and sent to the Bergen Museum, Norway, by the same firm. Later a second skull was received at the British Museum from the same region, which Lydekker now states as Szechwan (1909b, p. 610). This second skull was made the type (1907) of the new subspecies *U. m. wardi*, but, since the skull characters are quite the same as those of the typical *H. malayanus*, the sole differentiating trait lies in the longer hair, and even this Lydekker thinks may be an error, for the description of the skin at Bergen seemed to him possibly applicable to "*Ursus torquatus*" instead, implying that the skull and mounted skin may not really be from the same animal! Nevertheless, he gives the second skull the distinction of a new name, omitting to mention its number or exact origin! Very likely the subspecies is not worthy of recognition. If these two specimens were from Szechwan, as Lydekker supposed, then the distributional area must also include southern Yunnan in suitable places. It certainly occurs in Tongking just south of the southern Yunnan border, as Mr. H. J. Coolidge, Jr., tells me. Should more specimens confirm the distinction of this bear from typical *H. malayanus*, it would still be necessary to consider the earlier name given by Heude, *H. annamiticus*, whose claims to recognition have yet to be shown.

More recently, Pocock (1932a), in reviewing the whole matter, sees very little reason to suppose the skulls in question came from China, and places *H. m. wardi* in the synonymy of *Helarctos malayanus*, a course which seems quite justifiable, but in the lack of additional facts, the case may for the present await more information.

Specimens examined:—One, the type, said to be from Szechwan (B. M.).

Family CANIDÆ

WOLVES, DOGS, AND FOXES

The Canidæ comprise a number of carnivorous genera, in which the body is adapted for running through its lightness and slenderness of limb, the digitigrade feet, with rather strong but non-retractile claws, and the loss of the entepicondylar foramen in the humerus. The tail is usually of moderate length only, and heavily haired or bushy. The skull has a long muzzle; the canines are well developed, though rather blunt, and the sectorial teeth, consisting of the last upper premolar and the first lower molar, are adapted for shearing by the enlargement of their main cusp and the compressed form of the blade. The upper molars and the second and third lower molars are provided with tubercular cusps for crushing, so that the complete set of teeth is decidedly heterodont, fitted for various functions. In the general structure of the skull, the rounded bullæ are conspicuous features as contrasted with the bears, and there is usually present an alisphenoid canal. The appendix is of rather characteristic form, attached to the side of the intestine, and more or less closely coiled.

Five genera of Canidæ are found in the Mongolian and Chinese area, including wolf, fox, raccoon dog and wild red dog. These may be distinguished by the following key:

KEY TO THE GENERA OF CHINESE AND MONGOLIAN CANIDÆ

A. Lower molars, 3.
  a. Size large, skull over 200 mm. long, teeth rather blunt ..... *Canis*
  b. Size smaller, skull less than 200 mm.
    a′. Muzzle slender, the distance from antorbital foramen to tip of incisors much exceeding width across molars.
      a″. Larger, skull length exceeding 125 mm ..... *Vulpes*
      b″. Smaller, skull length less than 125 mm ..... *Cynalopex*
    b′. Muzzle shorter, the distance from antorbital foramen to tip of incisors equaling the width across molars ..... *Nyctereutes*
B. Lower molars, 2, form dog-like, color red ..... *Cuon*

Genus **Canis** Linnæus

Canis Linnæus, Syst. Nat., ed. 10, vol. 1, p. 38, 1758.

Miller has shown that the genus *Canis* may be limited to the wolves and domestic dogs, the American prairie wolves and the Old World jackals, but even the two latter groups are less closely akin than the two former. The full number of teeth characteristic of placental mammals is just short of representation through the loss of the third upper molar only, giving: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{2}{3}$ = 42. In general form the teeth are much alike in the members of the genus, but in typical *Canis* they tend to be rather full and plump in appearance, rather than

slender and compressed as in the American coyotes. The incisors are nearly in a transverse row, somewhat chisel-shaped, and the outermost above is separated from the canine by a space. The premolars of both jaws are compressed, with blades trenchant but rather short and conical; the last upper premolar has a small antero-internal cusp but is in general a large, compressed blade with the point of the main cusp just back of the center of the tooth. The upper molars are tubercular, showing clearly the outer paracone and metacone of equal size but low, with the well-developed protocone and hypocone on the inner side. The second upper molar is much smaller, scarcely half as large in crown area as the first. The three lower molars form a rapidly decreasing series, the third hardly more than a rounded peg with a low central cusp. The feet have five clawed digits on the anterior and but four digits on the posterior pair. In the skull, the forehead is distinctly elevated, and this portion contains sinuses. The genotype is *C. familiaris*, the dog.

The number of recognizable forms of wolves is far from being well made out. Indeed, it may be that the typical *Canis lupus* of northern Europe extends without important change quite across the northern part of Asia as well. Sowerby regards the Manchurian wolf as the same as the European; on the other hand, several names have been bestowed upon Far Eastern wolves without very much regard for variation of a purely individual nature. At present I have referred the Chinese and Mongolian wolves to one race.

163. **Canis lupus chanco** Gray

THE WOLF

Canis chanco Gray, Proc. Zool. Soc. London, 1863, p. 94.

Lupus laniger Hodgson, Calcutta Journ. Nat. Hist., vol. 7, p. 474, 1847 (not *Canis laniger* Hamilton Smith, Jardine's Naturalist's Library, Mammals, vol. 10, p. 134, 1840).

Canis lupus var. *chanco* Mivart, Monograph of Canidæ, p. 8, pl. 3, 1890.

Canis lupus Buechner, Bull. Acad. Imp. Sci. St. Pétersbourg, vol. 34 (new ser., vol. 2), p. 102 (Mélanges Biol., vol. 13, p. 148), 1892.

Lupus filchneri Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 157, 1908.

Lupus karanorensis Matschie, *ibid.*, p. 159.

Lupus tschiliensis Matschie, *ibid.*, p. 160.

Canis lupus tschiliensis Thomas, Proc. Zool. Soc. London, 1909, p. 967.

Canis chihliensis Zdansky, Palæontol. Sinica, ser. C, vol. 2, fasc. 1, p. 13, 1924 (fossil).

Canis lupus laniger G. M. Allen, Amer. Mus. Novitates, no. 360, p. 4, 1929 (not *Canis laniger* Hamilton Smith, 1840).

Type specimen:—The type specimen of Gray's *Canis chanco* is a skin and skull in the British Museum from "Chinese Tatary," shot by Lieut. W. P. Hodnell. The skin is figured in color by Mivart ("Monograph of the Canidæ," pl. 3, 1890).

Description:—The specimen from Chinese Tatary, on which the name *Canis chanco* was based, is described by Mivart as pale fulvous, the back having black and gray hairs intermixed. The head is grayish with short black and gray hairs on the forehead. Seven skins in the collections of the American Museum Asiatic Expeditions show wide variation in tints of color from light ochraceous, about as figured for the type of *C. l. chanco*, to pale gray. There is no reason to suppose that more than one form is represented among them. One of these from Kweihwacheng represents the extreme of brighter coloring. Its upper lip is narrowly edged with dull white; muzzle pale chestnut or ochraceous, slightly mixed with gray; entire forehead from the level of the eyes to the occiput, grizzled black, gray and ochraceous; cheeks below level of eye, grayish white, very slightly mixed with black; backs of ears clear bright ochraceous buff to ochraceous rufous, paler about their bases and white inside; nape ochraceous buff washed with black, sides of neck pale buff, shoulder similarly pale buff with a pale gray cross-bar; outer side of fore leg ochraceous buff, paling to a pale buff on the foot; a slight sprinkling of blackish-tipped hairs on the upper arm, which become concentrated to form a narrow, ill-defined stripe along the upper inner edge of the forearm. The back is a coarsely mixed ochraceous, black, and grayish white, the sides and belly clear pale ochraceous with a scattering of black-tipped hairs. The woolly hairs of the back are smoky basally, tipped with ochraceous buff, while the longer guard hairs are black at the base, then broadly ringed by whitish, and conspicuously tipped with black. Hind legs pale clear ochraceous rufous, feet nearly white with a slight buffy tint. Tail pale ochraceous buff, abundantly mixed with longer black-tipped hairs, which concentrate over the caudal gland, and at the tip; below, the tail is white for the basal third, then clear ochraceous buff as far as the black tip. Inner sides of limbs and belly pure white, except that the latter is faintly tinged with buff.

Other specimens may have the ears darker, almost ochraceous rufous, and the black line on the edge of the forearm narrow but clearly marked. A skin from Urga, Mongolia, perhaps a winter-killed specimen, is very pale. The muzzle above is pale ochraceous buff grizzled with whitish; forehead darker; backs of ears contrastingly ochraceous rufous; fore legs pale buff without trace of the dark stripe; neck, body and tail with the ochraceous tint reduced to buff, the white rings of the guard hairs on the back, prominent; belly white, the flanks whitish.

The description of the European Wolf as given by Miller (1912) fits the eastern wolf fairly well, but the latter does not quite equal in size of skull the measurements given for Swedish wolves.

Measurements:—No measurements of fresh specimens are available.

CRANIAL MEASUREMENTS OF *CANIS LUPUS CHANCO*

No.	Occipito-incisive length	Condylobasal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across upper molars	Upper cheek teeth	Lower cheek teeth	Locality
45602	233	220	209	114.0	121	78	72.0	99	113	Mongolia
57328	236	219	207	111.0	130	79	77.0	103	114	Mongolia
60111	246	228	213	116.5	135	77	73.5	102	116	Mongolia
MATSCHIE	241	—	215	———	120	—	72.5	—	—	Hopei
MATSCHIE	234	—	210	———	120	—	74.2	—	—	Kansu

Nomenclature:—Assuming that the eastern wolf is distinguishable from that of northern Europe, the first name applicable to it seems to be that of Hodgson, *Lupus laniger* of Tibet, a name I had used in a previous (1929) paper. This name is, however, invalidated by *Canis laniger*, given seven years before by Hamilton Smith to the woolly dog of the Puget Sound Indians. Probably Gray's *Canis chanco*, or Golden Wolf of Chinese Tatary, is the first available name after this, and since the description and figure of the type specimen by Mivart seem to agree well enough with Mongolian specimens examined, I have used it here. In 1908, Matschie gave names to Chinese wolves as follows: *Lupus filchneri*, based on a trade skin bought at Siningfu; *Lupus karanorensis*, based on a skin and skull from northwestern Kansu; and *Lupus tschiliensis*, based on a skull from the coast of Hopei. The characters given do not seem in any way distinctive, so that I have regarded these all as synonyms. Nevertheless they are available in case it should eventually prove, upon the study of adequate material, that there are local races of wolves in China.

Occurrence and Habits:—Wolves occur probably all over Mongolia and North China as far south as the Yangtze valley. The American Museum Asiatic Expeditions secured specimens at Loh, and at a point one hundred and seventy miles northwest of Kalgan, and again at Urga, Mongolia, as well as another at Kweihwacheng, in northern Shansi. No doubt its abundance is regulated in any area by the amount of game available to supply it with food. In Hopei it still occurs. Weigold (1923) says that it is rare about Peiping at the Western Tombs. A native reported to him that his two dogs found a litter of wolf pups under a boulder some 35 km. from that locality, but the old wolf bit and drove away the dogs. The skull which Matschie made the type of *Lupus tschiliensis* was from the coast of that province at Shanhaikwan. In Shantung, Anderson (Thomas, 1908d) noticed that where wolves occur, hares have become scarce. In these two northern provinces, Sowerby (1926d) writes that wolves are less common, but in some of the Yangtze provinces are still numerous, as in Fukien, Kwangtung, and Kwangsi. In the Chinkiang district and along the range leading toward Nanking, as well as to the north of Pukow (north bank of the Yangtze) in the Sanchieh district, they are also

common. He says (1923g) that those of northern Shansi and southern Mongolia are paler in color than those from farther south, as well as larger. Usually they hunt singly or in pairs, sometimes in threes but only rarely in larger numbers. Notwithstanding Sowerby's statement that the wolf occurs in Fukien and Kwangtung, no specimens seem to have been taken, and the report should be definitely confirmed. M. P. Anderson, who secured a specimen at Yenanfu, Shensi, says that it is much feared by the sheep and goat herders of that country. Its occurrence in northwestern Kansu is attested by Matschie and by Buechner. E. H. Wilson in his "Naturalist in Western China," writes that wolves are very rare in central China, but as might be expected are more numerous on the Tibetan border, especially in the grasslands, where game may be had. Large numbers of their pelts are sent into western China by way of Tatsienlu, Monkongting, and Sungpanting, coming no doubt mostly from Tibet. Wilson remarked their variability in color, though most of them were pale gray, with the hair on the back black-tipped. The largest pelt he obtained measured 70 inches in total length. Skins of two wolves, old and mangy, were brought to him at Ichang that had been killed near there.

During the course of Dr. Andrews's work in Mongolia, he and his party found wolves fairly common, and they saw single ones now and then all along the way from Tsetsen Wang to Sannoin Khan. At the former place, Dr. Andrews writes that a litter of three wolf pups was found, and two of them were dug out of the den in the ground at the upper end of a canyon where the party was encamped. The old wolf meanwhile stayed on the summit of a mountain half a mile away and howled at them but did not return to the den during the night. According to Sowerby, many skins come from Mongolia to the markets at Tientsin. "The natives usually poison the wolf, though in North Shensi and on the Ordos border, they use a clumsy but effective gin trap of native design." Natives sometimes ambush them along the trail.

Specimens examined:—In all, seven, viz.:

Mongolia: One hundred and seventy miles northwest of Kalgan, 1; Loh, 2; Urga, 1.
China: Shansi: Kweihwacheng, 1; no definite locality, 2.

Genus **Nyctereutes** Temminck

Nyctereutes Temminck, in Van der Hoeven's Tijdschr. Natuur. Geschied. Physiol., vol. 5, p. 285, 1838-39.
Canis of authors, in part.

The Raccoon-dog is a small fox-like animal with short legs and short tail, thus differing noticeably from the true foxes. Its skull has a short muzzle, in which the distance from the antorbital foramen to the tip equals instead of exceeds the width across the molars. The profile of the forehead is flat and sloping, and there is a sharp and sudden depression at about the proximal third of the nasals. The lambdoid and sagittal crests are prominent in adult

skulls, the latter, however, a low median ridge, forking at the fronto-parietal suture and thence continuing on each side to the back edge of the postorbital process. In palatal aspect, the tooth rows at their posterior end do not reach the level of the interpterygoid fossa. The teeth are small and weak, with no striking peculiarities. The formula is: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{2\,(-3)}{3}$ = 42, in which the occasional presence of a third upper molar is recorded in two specimens, and may occur more often than this would indicate. The outer upper incisor is slightly separated from the second, and the first and second premolars in both jaws may be slightly spaced. The lower fourth premolar has a single supplementary posterior cusp in addition to the cingulum cusp, while the three others have merely the cingulum cusp. The color pattern of this dog is further distinctive in its dark eye patches, whence the name Raccoon-dog. There is but a single species, yet various geographic forms have been named, for none of which do the characters seem very marked.

164. **Nyctereutes procyonoides procyonoides** (Gray)

THE RACCOON-DOG

Canis procyonoides Gray, Illustrations of Indian Zool., vol. 2, pl. 1, 1834.
Nyctereutes sinensis Brass, Nutzbare Tiere Ostasiens, Neudamm, p. 22, 1904.
Nyctereutes stegmanni Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, pp. 175, 180, 1908.
Nyctereutes procyonides Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 7, 1922.
Nyctereutes procyonoides stegmanni A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 23, 1929.

Type specimen:—The species was founded on a specimen sent by John Reeves from China, and figured in Gray's "Illustrations of Indian Zoology." What became of the animal is not known, so that the plate is the basis of the name. Thomas states that Reeves was stationed at Canton during most of his stay in China, hence that vicinity may be taken as the type locality.

Description:—Small, fox-like animals, with short bushy tail. Color a mixture of buff, gray, and black, the black-tipped hairs predominating over the back and in a narrow dorsal area forming an ill-defined line from the crown to the tip of the tail; a conspicuous blackish-brown patch on each side of the face from just in front of and below the eye to a point midway to the ear, and continued as a narrower line behind the ear. The flanks, sides of neck and the tail are chiefly a warm buff to ochraceous buff, giving a slight pinkish tinge; feet blackish brown to chocolate brown.

The general characters of the skull have already been mentioned, with short muzzle, low forehead, and depression in front of the orbit in side view. The nasals are narrow, and extend as far back as the level of the ascending portion of the maxillaries. Sides of muzzle rather square. Lambdoid crests prominent, median crest low but prominent, its anterior branches extending to the back edge of the postorbital processes. In palatal aspect, the front of the interpterygoid fossa does not quite reach the level of the last molars.

Anterior premolars simple, in the upper jaw without accessory cusps, but in the lower jaw the fourth has a single low accessory cusp on the posterior margin. Upper carnassial with well-developed antero-internal lobe; the lower carnassial with the metaconid lower than the protoconid and partly visible behind the shoulder of the latter in profile. In one specimen examined, there is a third upper molar on the left side, with a crown area about one-fourth that of the second molar, and provided with small but evident paracone and metacone, and a much worn protocone. Thomas has recorded a similar case in which there was a third molar on the right side above, so that the loss of this tooth may not have become fully fixed as yet.

Measurements:—An adult from Wanhsien, Szechwan, measured: head and body, 505 mm.; tail, 170; hind foot, 112; ear, 50.

CRANIAL MEASUREMENTS OF *NYCTEREUTES*

No.	Condylobasal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width of brain case	Length of nasals	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
					N. procyonoides procyonoides							
38326	117.0	112.0	61.0	66.0	41.5	42.4	40.0	36.3	47.0	54.0	♂	Kiangsu
57113	113.5	106.0	58.0	63.0	41.0	41.5	41.0	36.0	44.0	51.0	♂	Shansi
57115	114.0	109.0	58.5	62.0	40.0	40.5	38.5	35.0	47.2	52.0	♂	Szechwan
60193	108.5	103.3	56.0	59.0	41.5	39.0	38.0	34.6	43.2	50.0	♂	Fukien
84434	114.0	109.0	58.0	64.0	41.5	40.5	36.6	35.5	46.0	52.0	♂	Fukien
84435	108.0	103.0	57.0?	58.0	39.0	39.3	——	34.3	44.0	50.0	♂	Fukien
84437	111.0	104.8	58.0	68.5	41.0	41.5	37.7	37.0	45.5	52.0	♂	Fukien
84438	111.5	106.0	57.8	62.3	38.5	39.5	38.0	34.0	43.4	50.0	♂	Fukien
59323	——	106.0	56.5	62.3	41.5	43.0	41.3	34.3	41.3	51.8	♂	Fukien
Average	112.2	106.5	57.7	62.7	40.6	40.8	38.8	35.2	44.9	51.4		
43140	110.0	104.3	55.8	63.0	43.0	41.6	38.0	35.0	44.0	51.0	♀	Fukien
45333	106.3	101.0	52.2	59.0	39.3	38.5	34.8	35.0	42.6	48.6	♀	Fukien
59322	104.0	98.0	52.0	59.5	39.0	39.0	32.5	33.0	41.0	47.0	♀	Fukien
58370	113.0	107.0	58.2	64.3	42.0	39.6	40.0	35.2	45.3	52.3	♀	Szechwan
60123	110.0	105.0	57.5	63.0	41.8	41.2	39.6	34.5	44.2	47.3	♀	Fukien
84342	110.0	104.5	57.4	60.0	39.5	40.6	38.3	34.5	45.5	51.2	♀	Szechwan
84436	109.0	106.0	58.0	65.7	41.7	42.0	39.5	33.8	43.5	49.5	♀	Fukien
57340	106.2	101.3	55.4	61.0	38.0	38.3	39.0	33.5	44.5	49.5	♀	Hunan
Average	108.0	103.3	55.8	61.9	40.5	40.1	37.7	34.3	43.8	49.5		
					N. procyonoides orestes							
43142	106.0	100.5	53.0	57.0	38.0	32.0	36.8	36.0	41.0	48.7	♂	Yunnan
43143	108.5	102.6	56.3	58.0	40.0	32.5	40.2	36.0	43.2	48.5	♀	Yunnan

Nomenclature:—*Nyctereutes* is nearly allied to *Alopex*, the Arctic Fox, but the tail is shorter, muzzle less elongate, the four anterior upper incisors in a nearly transverse row, the two outer incisors separated by a slight space and set posterior to the others. The brain case is more roughened. Brass, in 1904, named as *N. sinensis* the *Nyctereutes* of the Yangtze valley, but Matschie very properly considered this a synonym of *N. procyonoides*, though at the same time naming *N. stegmanni* from a specimen from Chinkiang, on the ground of slightly larger size and certain color differences, which are, however, individual rather than specific. With more abundant material than Matschie had, I do not see any way in which the Yangtze or other specimens from southern China can be subdivided, a conclusion previously reached by Jacobi (1922). Whether or not those from North China are slightly different has not yet been ascertained because of lack of specimens, but it may be that they are intermediate in size or other characters between the animal of southern China, typical *N. p. procyonoides*, and the one to which Matschie has given the name *N. ussuriensis*. There is a very wide range in color among individuals of this species from the same general locality, with even albinistic and melanotic or often wholly yellowish specimens, so that subdivision into local races on skin characters alone is difficult.

Occurrence and Habits:—This is a common animal in parts of China, particularly in Chekiang, Kiangsu, and Kiangsi, in the eastern part, as well as farther south in Fukien. According to Brass, his experience as a fur dealer led him to the conclusion that those from the three provinces first named are better furred than those from higher up the Yangtze valley in Hunan, Hupeh, or Anhwei. It is much used in fur. Mell, writing in 1922, states that until 1914 it was common in the Canton markets, and wild individuals even came to the edge of the city, but that since then he had not seen any, perhaps as a result of frequent and disastrous floods. It seems to be of less common occurrence in northern China. Sowerby (1923g, p. 47) writes that it is less an animal of the forest than of the grassy and willow-grown flats bordering the larger rivers, and that it is found in the Tungling region east of Peiping. Large numbers are exported for fur through Tientsin, that have been trapped farther north in Amur or Manchuria. In addition to specimens from Fukien, Chekiang, and Kiangsu, the American Museum Asiatic Expeditions obtained it in the Yangtze valley on the borders of Szechwan near Wanhsien, and A. B. Howell (1929) has recorded two skins in the U. S. National Museum from Suifu, in that province. The skin and skull from Lingcheng River, Shansi, brought back by Dr. R. C. Andrews, is interesting for the locality, perhaps near the northwestern bounds of the range. Mr. Clifford H. Pope, who secured

specimens near Futsing, Fukien, writes that it is not common there. He succeeding in digging out two from a hole in a thicket where a stream crossed a thickly settled plain. The native name was given as "t'u kou" (ground dog).

Little seems to have been recorded of the habits of this species. Mell (1922) corroborates Sowerby's statement that it lives in thickets near water, and adds that it feeds to some extent at least on fish, for he found fish in the stomach of a dead specimen, and this food is taken readily by captive animals. An animal in the London Zoölogical Gardens gave birth to a litter of seven young on May 2, 1877 (Proc. Zool. Soc. London, 1877, p. 530). Garrod (1878) has published some account of the visceral anatomy.

Specimens examined:—In all, twenty-two, as follows:

Chekiang: Tunglu, 1.
Fukien: Futsing, 11; Foochow, 1; Yenping, 1 (skull).
Hunan: Yochow, 1 (skull).
Kiangsu: Chinkiang, 1.
Shansi: Lingcheng River, 1.
Szechwan: Wanhsien, 3; Suifu, 1.
No exact locality, 1.

165. **Nyctereutes procyonoides orestes** Thomas

Nyctereutes procyonoides orestes Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 11, p. 657, 1923.

Type specimen:—The type is a skin and skull of a female, No. 23.4.1.20, British Museum, shot in the forest at about 10,000-12,000 feet, on the northwest flank of the Likiang Range, Yunnan, China, by George Forrest.

Description:—A slightly paler race, very similar to that of southeastern China, but differing chiefly in the gray instead of buffy tone to the paler portions of the longer hairs, though there may be in some specimens a very slight suffusion of buffy. The throat and feet are described as black in the type, but in four other skins examined are brownish.

The skull of the type was said to differ in the nearly parallel condition of the zygomatic arches, but this must have been somewhat abnormal, and an individual aberration, since two skulls from the same area are indistinguishable from those of the typical race.

Measurements:—The measurements of these two skulls are given in the table under *N. procyonoides*. Thomas mentions also that the type specimen had a third upper molar on the right side, a condition previously mentioned in a specimen of the typical race from Fukien.

Occurrence and Habits:—This is a very slightly characterized form, if

indeed it may not eventually prove to be altogether indistinguishable from the lowland animal of the east. The four skins from Likiang obtained by the American Museum Asiatic Expeditions, however, agree in having a somewhat grayer, less buffy general tone, and I have, therefore, regarded the form as provisionally entitled to recognition. A. B. Howell (1929) has recorded a skin in the U. S. National Museum from the Likiang plain. The range of the race is thus far known to be only the Likiang region of western Yunnan.

Specimens examined:—Four, two with skulls, from Likiang, Yunnan.

Genus **Vulpes** Oken

RED FOXES

Vulpes Oken, Lehrbuch d. Naturgesch., vol. 3, pt. 2, p. 1033, 1816.

The typical foxes are slenderly built, graceful animals, with fairly large ears, and long, thickly furred tail forming a "brush." The chief characters of the skull are the long and slender muzzle, in which the distance from the antorbital notch to the tip is considerably more than the width across the molars. The dorsal profile of the skull shows very little inflation of the sinuses of the forehead, which is flattened and slopes gently to the lower plane of the nasal region. The postorbital processes are low and flattened, slightly excavated above, their posterior corner continuous with the temporal ridges. The interpterygoid fossa extends forward at least to the level of the last molars. The upper incisors form a slightly curved row; the upper canines are very long and slender, their tips reaching the level of the ventral border of the jaw when the latter is closed. The premolar teeth are slightly more narrow and trenchant than in *Canis*, but the tooth formula is the same.

The Red Foxes are of wide distribution quite across the temperate regions of Europe, Asia, and North America. Although a great number of local races have been named over this vast area, it is nevertheless true that there is much purely individual variation in color, so that characters of this sort are more difficult to evaluate. In general, however, there is likely to be found a certain correlation between paleness and aridity, richness of color and humidity, or other differences with widespread factors of climate.

The type species is *Canis* (= *Vulpes*) *vulpes* Linnæus of Europe, represented by closely allied subspecies in Mongolia and China.

166. **Vulpes vulpes hoole** Swinhoe

SOUTH CHINA RED FOX

Vulpes hoole Swinhoe, Proc. Zool. Soc. London, 1870, p. 631.
Vulpes lineiventer Swinhoe, *ibid.*, p. 632.

Vulpes alopex Buechner, Bull. Acad. Imp. Sci. St. Pétersbourg, vol. 34 (new ser., vol. 2), p. 102 (Mélanges Biol., vol. 13, p. 148), 1892.

Vulpes aurantioluteus Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1 p. 168, 1908.

Vulpes ferrilatus eckloni Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 6, 1922.

Vulpes huli Sowerby, Naturalist in Manchuria, vol. 2, p. 44, 1923.

Vulpes vulpes aurantioluteus A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 24, 1929.

Type specimen:—The type skin of Swinhoe's *Vulpes hoole* as well as that of his *V. lineiventer* are both preserved in the British Museum. The former, No. 62.12.24.6, is from the plains country near Amoy, Fukien, China, and the latter from the hills at no great distance from the same locality. They represent color variations of the same species, and since *V. hoole* is first in his list of names, it is given precedence.

Description:—In general color, this fox much resembles the European species, but the sides and especially the thighs are more mixed with gray and the fore feet usually have less black, while the red tones are less fulvous but duller chestnut; the tail has the chestnut more confined to the upper surface, while the lower side is buffy white, the long hairs tipped with black. Color below, white to gray or even with a decided pinkish tinge. As a rule the clear chestnut area is confined to a rather narrow median stripe with ill-defined boundaries, becoming more rufous on the tail. The flanks are bright ochraceous, frosted with gray-tipped hairs which especially predominate on the sides of the haunches. A blackish area on the sides of the muzzle may be well developed, or very indistinct, or again wanting altogether; the black stripe on the front of the fore leg is usually narrow, bordered by rufous, but may be broad enough to cover the entire front of the leg and extend up on the shoulders. In dark specimens the throat and belly are suffused with slaty where the dark bases of the hairs show through, and in one skin the wearing away of the white tips of the hairs results in an indistinct blackish collar. Usually a narrow line of clear bright ochraceous runs along the sides bordering the paler color of the belly, which is usually white with grayish under fur. Occasionally the whole under side of the body is pinkish buff. The opposite variation is seen in specimens in which the whole belly is blackish, but this is less common. It was a specimen of this sort that formed the type of Swinhoe's *V. lineiventer*. A skin from Yunnan (Likiang) is slightly melanistic, in that the fore and hind feet are black and the entire tail is much darkened with the same; the back is deeper fulvous than usual.

Measurements:—Few measurements of fresh specimens are available. A female from Maitaichao, Shansi, measured in the flesh as follows: total length, 1,003 mm.; tail, 387; hind foot, 150; ear, 94.

CRANIAL MEASUREMENTS OF *VULPES VULPES HOOLE*

No.	Condylo-basal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth c-m^2	Lower cheek teeth c-m_3	Sex	Locality
59312	127.0	120.5	67.0	70.5	43.5	37.6	59.5	67.8	♀	Fukien
59313	127.0	122.0	67.5	70.0	44.8	37.5	59.0	67.0	♀	Fukien
59314	131.5	125.0	70.0	73.0	46.5	40.0	61.5	69.0	♂	Fukien
60130	132.0	127.3	70.2	77.0	47.0	41.4	61.8	69.0	♂	Fukien
84400	——	——	69.0	70.2	——	39.5	62.0	70.2	♀	Fukien
84401	129.5	125.0	68.5	73.0	45.0	39.0	60.5	68.2	♀	Fukien
84402	140.0	134.0	74.0	——	48.5	40.5	64.5	73.0	♂	Fukien
84404	138.0	——	75.0	78.5	47.5	41.5	64.0	73.5	♂	Fukien
57071	136.5	131.0	75.7	78.0	45.5	40.5	63.2	70.0	—	Hunan
60098	136.0	130.0	72.0	69.0	44.0	36.0	63.8	71.5	—	Szechwan
62.12.24.6 BM (type)	132.5	123.5	66.2	75.8	46.5	40.5	59.7	66.2	—	Fukien

From the above measurements, it is seen that the males in the series from Fukien (Futsing) average a few millimeters larger than the females.

Occurrence and Habits:—The Red Fox is found over the greater part of China, but becomes rare and finally absent in the southern portions. Swinhoe found it common about the bare granitic hills near Amoy. When pursued they escape by springing from rock to rock with such agility as easily to outdistance a greyhound, but on the plains they are more readily run down. Swinhoe states that he has seen foxes on the island of Hongkong as well. South of this general area they seem to be fewer or absent. Mell, writing from Canton, does not mention their presence near there. Mr. Clifford H. Pope secured a series at Futsing, in northern Fukien, and writes that they are common here on the plains and among the open grassy hills and low mountains of Futsinghsien, boldly roaming over the hills and through fields in the numerous villages. These villages are commonly located at the base of the grassy hills just above the irrigated plains where rice is grown, and the foxes come down at night to prowl around in search of food. Specimens were easily obtained by stationing men with guns in ravines above the villages and driving the foxes with dogs back toward the hills. Inland from eastern China, the Red Fox seems to be less common, though generally distributed. Dr. J. A. Allen (1909a) recorded a specimen from Taipai Shan, Yumonko. Jacobi (1922) mentions a skin secured at Ichang and another at Batang on the western border. Matschie (1908) made a skin from Tatsienlu the basis of his *Vulpes aurantioluteus*, but it does not appear to be sufficiently distinct for recognition. A. B. Howell (1929) refers to it, however, a skin in the U. S. National Museum from Suifu, Szechwan, and a second from the Min Shan of southern Kansu. Weigold (1923) mentions seeing a Red Fox at Wa Shan, Szechwan, and

Thomas (1911d) has recorded a specimen secured near Sihohsien, southern Kansu, the relationship of which he regards as "not clear."

Fox skins are in much demand for fur and many are sold in the markets. It was from such a source that the type of Matschie's *V. aurantioluteus* came, so that it may not be possible to tell its exact locality. Mell speaks of obtaining a skin in Talifu, Yunnan, and apparently the handsome specimen previously mentioned from Likiang was a native skin.

Little definite information seems to be on record as to the habits of the Chinese Red Fox. It apparently thrives in close proximity to man, even in country long cultivated, as about Tientsin and Futsing, possibly finding life easier in such places than in the less-settled areas. Two very small pups were secured at Futsing on January 5, 1926.

Specimens examined:—In all, twenty-five, as follows:

Chekiang: Tunglu, 1.
Fukien: Futsing, 16; Yuki, 1; Amoy, 1 (B.M. type); Foochow, 2 (B.M.).
Hunan: Yochow, 1.
Szechwan: Wanhsien, Yenchingkou, 1.
Yunnan: Likiang, 1.
No definite locality, 1.

167. **Vulpes vulpes tschiliensis** Matschie

NORTH CHINA RED FOX

Vulpes tschiliensis Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 169, 1908.
Vulpes vulpes tschiliensis Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 6, 1922.

Type specimen:—The type is a mounted skin, No. 5660, in the Berlin Museum, in which the essential point of difference emphasized by the describer was that the ears are dark brown instead of black. The specimen came from Peiping, Hopei, China. A second skin from the same locality, Matschie described as having the ears black as usual, so that the peculiarity of the type may be an individual one, or the specimen may have become faded through exposure to light. Nevertheless, although the color differences are admittedly none, as compared with *V. v. hoole*, the skull seems to be larger, and on that ground the race is here recognized.

Description:—Similar in color characters to the fox of South China, *Vulpes v. hoole*, but size slightly larger as shown by the greater size of the skull. Jacobi (1922) records a skin from Peiping as corresponding in all particulars to the description of Matschie, but whether this implies brown ears or black ears is not clear.

The skull of Chinese foxes is slightly smaller than in typical *V. vulpes* of Sweden and the teeth are a trifle less in size. The large skulls of *V. v. tschiliensis*, however, seem to equal those of Europe.

Measurements:—Comparative measurements of the North China Fox are not available except for those of the skull.

CRANIAL MEASUREMENTS OF *VULPES VULPES TSCHILIENSIS*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Mas-toid width	Width across molars	Upper cheek teeth $c\text{-}m^2$	Lower cheek teeth $c\text{-}m_3$	Sex	Locality
57070	159.0	154.0	85.5	83.0	50.0	42.5	72.5	80.0	—	Hopei
MATSCHIE	157.0	——	——	84.9	48.8	42.1	——	——	—	Hopei
MATSCHIE	156.0	——	——	82.9	47.3	42.3	——	——	—	Hopei
90.7.8.3 BM	150.5[1]	——	76.0	75.8	——	41.4	70.0	88.8	—	Hopei
11.11.1.7 BM	157.5	146.5	79.1	84.1	50.0	44.5	69.7	77.9	♂	Shensi
11.11.1.8 BM	161.3	149.2	82.4	86.8	52.0	44.2	71.5	80.0	—	Shensi
11.6.1.4 BM	149.0	140.5	74.8	81.5	49.5	41.0	68.8	75.5	♂	Shensi
11.2.1.83 BM	148.5	137.0	75.0	75.7	48.0	40.5	66.5	75.5	♀	Kansu

[1] In this and the four following, this measurement is "greatest length," which is about the same.

Occurrence and Habits:—The Red Fox of the vicinity of Peiping seems so consistently larger of skull than that of South China, that Matschie was probably justified in separating it as a distinct form, though doubtless of subspecific rather than specific rank. The dimensions of two skulls that he had from Peiping agree with those of a third secured by Dr. Roy C. Andrews from the same region. Jacobi (1922) has also recorded a Peiping specimen, but gives no details beyond the statement that it corresponds with the original description, except in having the tail a strong reddish brown or chestnut brown above with a black ring about the basal fourth. That the species still persists about so thickly settled and well-cleared a region as Peiping speaks again for the cleverness of the Red Fox. I have found little to indicate how far it extends to the west and north, or if it occurs in any numbers, but Thomas (1908e) quotes the observation of M. P. Anderson who noticed a family of foxes near Tabool, on the edge of the Mongolian plateau: "they were evidently very shy, for on seeing us one day they forsook the place and did not return."

On the basis of slightly greater size, as shown in the "condylobasal length" measurement and others, the foxes of North China are tentatively referred to this race, although the differences are not always very obvious, especially when the sex and age of the specimen are unknown.

The records show that the range extends across northern China, through at least southern Shansi and Shensi to southern Kansu (Thomas, 1911e, p. 688, from Si Ho; Buechner, 1892, from Ssigu, Kansu). All these and others are probably to be referred to *V. v. tschiliensis*, which is in turn so similar to the European Red Fox that it is barely distinguishable. Indeed, Thomas (1908f) refers three from Taiyuenfu, Shansi, to the typical form, while Hilzheimer (1906), in recording a skin from Szechwan and two from Pingshiang, in the

Strassburg Museum, says that the skulls are hardly different from those of the latter. Cabrera (1922) pointed out that the South China Fox is a very little smaller and the dentition slightly weaker. Nevertheless, the differences are so inconsequential that it is difficult if not almost impossible to separate Chinese skins from European when placed together in the same series.

Specimens examined:—Ten, as follows:

Hopei: Eastern Tombs, 1; Peiping, 1 (B.M.).
Shensi: Fengsiang, 2, plus 3 (B.M.).
Kansu: north of Sihohsien, 1 (B.M.).
Shansi: Maitaichao, 2.

168. **Vulpes vulpes ?karagan** (Erxleben)

DESERT RED FOX

Canis karagan Erxleben, Syst. Regni Animalis, Mammalia, p. 566, 1777.
Vulpes vulpes karagan Satunin, Conspectus Mammalium Imp. Ross., p. 139, 1914.

Type specimen:—The name seems to have been based on Pallas's description of the Karagan of the Kirghiz steppes, rather than on any specimen. As Ognev points out, Mivart and others seem to have confused this with the Corsac.

Description:—This is a pallid, desert form of the Red Fox, of a straw yellow with rusty on the back, neck and shoulders, the paws straw yellow, with or without black marking. The dark spot on the side of the nose may be hardly defined, but instead rusty yellow. Ears black as usual.

CRANIAL MEASUREMENTS OF *VULPES VULPES KARAGAN*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Mas-toid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
57335	148	139	78.7	78	48.5	41.3	69	78.4	♂	Mongolia

Nomenclature:—The type locality of this fox is western Siberia, in the Kirghiz steppes, obviously a long distance from Mongolia, yet on account of the apparent similarity, so far as can be judged from descriptions, I have provisionally referred the Red Foxes of the Gobi to this same race. Ognev, in his recent (1926) review of the foxes of the Russian Empire, mentions a skin collected by Kozlov hear Kiakhta and another from the steppes of southern Transbaikalia that appear to be the same, at least he so regards them pending more ample data to the contrary. The additional forms that he names, *V. v. ochroxantha* from the Tian Shan, and *V. v. jakutensis* from south of Yakutsk, do not seem to be very different.

Occurrence and Habits:—This is a pallid desert-living fox of the Gobi of Mongolia. It is unfortunate that the few specimens taken are either so young

or in such a condition of wear that the characters are not well ascertainable. The feet and noses of the adults, however, seem to be much paler in color than in the foxes of South China.

Dr. R. C. Andrews writes that these foxes are not rare in the general region about Loh. He saw two in "bad land" ravines, and at Tsagan Nor shot one of two that evidently was stalking some ducks in the tall grass by the water's edge. No doubt, like so many other mammals of the Gobi, the range extends to the westward through the dry country to western Siberia.

Specimens examined:—In all, four, as follows:

Mongolia: Tsagan Nor, 1 (adult skin and skull); Tsetsen Wang, 2 (immature); Loh, 1 (skull).

Genus **Cynalopex** Hamilton Smith

Cynalopex Hamilton Smith, Jardine's Naturalist's Library, Mammals, vol. 9, p. 222, 1839. Thomas, Proc. Zool. Soc. London, 1929, p. 105.
Canis Radde, Reisen im Süden von Ost-Sibirien, vol. 1, p. 67, pl. 3, figs. 2-7, 1862 (in part).
Vulpes Ognev, Ann. Mus. Nat. Hungarici, Budapest, vol. 23, p. 203, 1926 (in part).

The genus *Cynalopex* is not very sharply marked off from *Vulpes*, but, as Thomas (*loc. cit.*) says, includes the Corsac and certain other small Asiatic species as well as all the smaller foxes of Africa except the Big-eared Foxes (*Otocyon*) and the Fennec (*Fennecus*). In its general build it is slender with a tail proportionately long as in the Red Foxes (*Vulpes*), but the species are all much smaller, with ears short and bullæ large, the interorbital space relatively broader and less concave, the temporal ridges in the adult uniting posteriorly but extending forward in lyrate form; the muzzle is slender, the distance from front of middle incisor to back edge of antorbital foramen exceeding the width across the molars, but it is less elongate than in the Red Foxes. In the upper incisors the lateral cusps are practically absent; the outer incisor is separated by a slight space from the others and set somewhat posterior to their line.

In giving the name *Cynalopex*, Hamilton Smith proposed it as a section of *Chaon*, a subgenus of *Canis*. Thomas, in regarding it as of generic rank, did not give any diagnostic characters, but named as genotype *Canis corsac* Linnæus.

A single species occurs in the Gobi westward into the steppe country of central and western Asia.

169. **Cynalopex corsac** (Linnæus)

CORSAC FOX

Canis corsac Linnæus, Syst. Nat., ed. 12, vol. 3, appendix, p. 223, 1768. Hamilton Smith, Jardine's Naturalist's Library, Mammals, vol. 9, p. 222, pls. 16-18, 1839.
Vulpes corsac Ognev, Ann. Mus. Nat. Hungarici, Budapest, vol. 23, p. 203, 1926.

Cynalopex corsac Thomas, Proc. Zool. Soc. London, 1929, p. 105.

Type specimen:—None in existence. The type locality is taken as the "steppes between the Ural and the Irtish" (Ognev, 1926).

Description:—Radde says that the coloration in winter coat is fairly constant, the tips of the hairs over the back varying from pale rusty brown to dull smoke brown on a ground color that may be slightly more reddish or more brownish gray. Slightly longer hairs with pale tips are interspersed. Dark mark at the side of the snout absent or only faintly indicated. Backs of ears like the back instead of being black as in the Red Foxes, their inner side well clothed with long white hairs. The outer sides of the limbs are rusty, their inner surface, the side of the muzzle, throat, and belly white. Basal part of tail like the back, the terminal half gray; the caudal gland is marked by a spot of black near the middle of the tail, and there is no white tip.

Measurements:—Ognev quotes from Dinnick the following measurements: total length, 750-950 mm.; tail, 250-350; ear, 80; height at shoulders, 30.5.

CRANIAL MEASUREMENTS OF *CYNALOPEX CORSAC*

No.	Condylo-basal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Orbit to snout	Locality
85021	118.0	113	—	—	42.3	35.5	55.8	61.4	51	Gobi
RADDE	117.5	108	—	66	——	——	——	——	—	Gobi

Occurrence and Habits:—This little fox is an animal of the open steppes and semidesert country from southern Transbaikalia westward to the Ural region. Möllendorff (1876) says that it is common in Mongolia and occurs as far east as the northwestern part of Hopei. Evidently, however, it is difficult to secure in this area, for the Central Asiatic Expeditions succeeded in procuring only a skin and skull of a young individual at Shara Murun, and a picked-up skull in the Gobi. At the northeastern edge of the Desert, Radde found it in the Tarei Nor region and middle Onon valley, becoming rarer on the east and west slopes of the Kentai and Apple Mountains. In the northern parts of its range he says that it is partly migratory, moving south in winter, often in large numbers. It is seldom seen by day, but spends that time sleeping in disused marmot holes. In times of snow, the hunters track them to such burrows, and set a snare at its mouth, which catches the fox when it emerges. Old animals, however, may be so shy that on perceiving the snare they retire again into the burrow rather than come out, and in some cases actually starve to death, to be dug out next spring. Again, after a week or nine days, they will often be forced out by hunger, and so are snared. Their food is said to be chiefly small species of microtines and the mouse-hares (*Ochotona*).

Specimens examined:—Two only, a skull from the Gobi, and a juvenile skin and skull from Shara Murun, Inner Mongolia.

Genus **Cuon** Hodgson

WILD RED DOGS

Cuon Hodgson, Ann. Nat. Hist., vol. 1, p. 152, 1838.
Cyon Agassiz, Nomenclator Zool., p. 113, 1846.
Anurocyon Heude, Mém. concern. l'Hist. Nat. de l'Emp. Chin., vol. 2, pt. 2, p. 102, footnote, 1892.

The Red Dogs are well characterized by their shortened muzzle, in which the distance from front of incisors to outer edge of the antorbital foramen is less than the width across the molars; by the incisor teeth forming a continuous transverse row; while the lower molars are modified through the loss of the third and great reduction of the second molar, whose crown area hardly equals that of the heel of the first molar. The tail is relatively shorter than in *Canis*, and the forehead hardly elevated. The second and third upper premolars have each a small posterior cusp at the base in addition to the cingulum cusp. The posterior upper molar is a small tooth with a crown area about as large as that of the metacone of the molar in front, and of about equal size with the posterior lower molar.

There is some uncertainty as to the number of species of this genus occurring in Asia. The latest authority, Wroughton, recognizes two in India, but admits that they may grade into each other. For the present, I have regarded the Wild Dogs of China as of a single species. The genotype is *Canis* (= *Cuon*) *primævus* Hodgson of Nepal, India.

170. **Cuon javanicus lepturus** Heude

Cuon lepturus Heude, Mém. concern. l'Hist. Nat. de l'Emp. Chin., vol. 2, pt. 2, p. 102, footnote, 1892.
Anurocyon clamitans Heude, *loc. cit.*
Canis aff. *dukhunensis* Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 22, 1922.
Cuon alpinus Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 7, 1922.
Cuon primævus A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 24, 1929.
Lycaon pictus Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 8, p. 1, 1930.

Type specimen:—Not known to be in existence. The type locality is Poyang, south of the Yangtze, Kiangsi, China.

Description:—Size of a small wolf; color bright rusty rufous, the tail slightly blackened and with a black tip; belly, throat and edge of upper lip usually white, though in some specimens there is a slight suffusion of reddish extending over the belly.

Four skins, two from western Yunnan and two from Fukien, are practically alike, of a deep rufous, paling on the belly, which is white in the center in two of the specimens and in the others suffused with ochraceous rufous. The tails are colored like the back, except that they are darkened by the black terminal portions of the longer hairs which tend to form a black tip. The feet are ochraceous rufous. The upper lip is narrowly white in three, but in

the fourth, which is an unusually dark-red animal, the lips, too, are dark reddish, the throat only a little marked with white, and the belly rufous.

Measurements:—No flesh measurements are available. The dimensions of skulls are given below.

CRANIAL MEASUREMENTS OF *CUON*

No.	Greatest length, occiput to incisors	Condylo-basal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Orbit to incisors	Upper cheek teeth	Lower cheek teeth	Locality
43144	174	164.5	150	—	101.5	64.0	67.0	73.3	78.0	Yunnan
19566 MCZ	177	171.0	164	87	110.0	69.0	71.0	74.0	79.0	India
30382 MCZ	167	163.0	—	83	104.0	58.5	70.3	70.8	77.2	Szechwan

Nomenclature:—No one yet seems to have studied the Wild Red Dogs of eastern Asia with sufficient material to determine how many forms are really valid of those described and named. A pallid form with long fur is found in Tibet and southern Siberia, *Cuon alpinus*, but is not known to reach China; Blanford distinguished the Red Dog of the Himalaya region and the Indian peninsula as *Cuon dukhunensis* (of Sykes, 1831), characterized by its large size, long hair with woolly under fur, and skull about 171-178 mm. in length; while the Red Dog of eastern India, with shorter coat, no under fur, and of smaller size, skull about 158 mm. long, he regarded as distinct under the name of *rutilans* (S. Müller, 1839).

[Since the foregoing account was written, Pocock, in 1936, has reviewed the Wild Red Dogs on the basis of the material available at the British Museum. He shows that all may be considered as races of a single species, for which the oldest name is *Cuon javanicus* Desmarest; type locality, Java. The number of races occurring in China he leaves still in doubt, but inclines to recognize *C. j. lepturus* of the Yangtze basin, for which, however, no very definite characters are given beyond the white upper lip. At the same time he describes from "western Szechwan" a new race, *C. j. fumosus*, based on a single skin in which the color is a yellower red, the pelage is thicker, and the mustachial bristles are black. Other races may enter the northern and northwestern borders of China and Mongolia.]

Occurrence and Habits:—The Wild Red Dog ranges across southern China from Fukien to Yunnan, and in western China seems to occur in southwestern Szechwan as well, for A. B. Howell (1929, p. 24) mentions a specimen in the U. S. National Museum from Tsiojiakeo in that province that was very red like the Wild Dog of India. Jacobi (1922) mentions also that Weigold purchased skins of adult and young in Sungpan, northern Szechwan, that were darker than Altai specimens representing *Cuon alpinus*, of a fiery red with darker tail, the young white-chinned. These skins of course may have been

sent in from some locality to the south and west. Weigold (1923) adds that the skin of a female was bought in Batang as well. E. H. Wilson (1913, vol. 2, p. 189) writes: "Wild dogs (Tsai Gho) haunt parts of western Szechwan and quickly drive or kill out all game animals. One afternoon, in 1908, when after pheasants, I saw eight or ten of these beasts within a mile of the hamlet of Tatienchih, situated at the foot of Wa shan. There were three or four together and very brazen, allowing me to approach within 100 yards of them before they slowly moved off. Wild pigs are common in this neighbourhood, and on one occasion Mr. Zappey saw a pig attacked and partly devoured in a few minutes by three of these Wild Dogs. This animal is rather larger than a Fox and decidedly lanky in appearance." In Yunnan, the American Museum Asiatic Expeditions succeeded in procuring a skin and skull at Shafun, and a second skin was purchased on the Namting River.

In southeastern China, the Red Dog still occurs in some numbers in the wilder parts. Père Heude, writing in 1892, said that he recognized two types on the right bank of the Yangtze: a uniformly red one with long, thin tail, to which he gave the new name *Cuon lepturus*, and a similar one with paler flanks and a shorter thicker tail for which he erected a new genus, naming it *Anurocyon clamitans*. A specimen of the former he had from Poyang, northern Kiangsi, and one of the latter from Taihu (Great Lake), near the mouth of the Yangtze. Probably the short-tailed condition of the animal he named *Anurocyon* was a result of some accident, for no doubt both forms are representatives of the same species. Sowerby (1929) notes that Wild Dogs are found still in Fukien, and the American Museum Asiatic Expeditions succeeded in obtaining two skins without skulls from near Yenping, where there is plenty of mountainous country. In the extreme south of China, Mell (1922) says that the Wild Dog is uncommon in the northern part of Kwangtung, among rocky and broken mountains. He had a large male killed at "Dragon's Head." On one occasion in the early morning a muntjac came bounding into a village (Tsogokwahn). The villagers say that when the muntjac seeks the refuge of a village, it is being pursued by some animal, so they waited expectantly, when presently a Wild Red Dog came bounding along on the muntjac's trail and was shot. Another was shot at the place called in the local dialect "Dragon's Head," as it was pursuing an *Elaphodus*. Two more were killed at Yuyuen, while attacking a tame water buffalo peacefully grazing. They had already wounded the animal badly before it could be rescued. Shih (1930a) has recorded the capture of two *Lycaon pictus* at Yao Shan, Kwangtung, doubtless intending this animal, whose English name, Hunting Dog, led him to apply the name of the African species inadvertently. Many stories are told of the ferocity and daring of these wild dogs. Few species of game seem immune from their attacks. They usually hunt in packs of a few to ten individuals. In India the young are said

to be born in the early part of the year, January to March, and vary in number from two to six in a litter. Very little seems to be recorded of their habits in China.

Wild Dogs were found, formerly at least, in parts of northeastern China, though in most eastern regions probably now exterminated. Möllendorff, writing in 1876, says they were then known to occur in northern Hopei, Kalgan, and Suanhwafu.

Specimens examined:—Five, including but two skulls, namely:

Fukien: Yenping, 2, skins only.
Yunnan: Shafun, 1; Namting River, 1 (skin only).
Szechwan: no exact locality, 1 skull (M.C.Z.).

Family MUSTELIDÆ

MARTENS, WEASELS, BADGERS, OTTERS

The Weasel family includes a number of carnivorous species, which typically are long-bodied, short-limbed and well-furred mammals, adapted to a northern climate, and abounding particularly in the northern hemisphere. Some of their members, as the badgers, have become modified for digging, through the development of stout, strong-clawed limbs, and heavy-muscled bodies. Others, still, as the otters, are partly aquatic, pursuing fish. They are provided with some sort of scent gland having a powerful musky odor, the location of which is usually in the anal region. With few exceptions, the entepicondylar foramen is retained at the inner distal end of the humerus; the five clawed digits are present on both fore and hind feet, but in the otters the claws are relatively weak, and the feet are webbed for swimming.

In the skull the bony palate is usually produced backward well beyond the tooth rows, and the latter are reduced by the loss of (usually) two molars above and one below, so that the molar formula is $\frac{1}{2}$. The upper molar is usually of characteristic form, with a broad inner lobe that is longer in the antero-posterior axis than the secant part at the outer edge of the tooth.

Pocock (1921b) has lately given an excellent summary account of the important external characters of the family. It has been found that in this family, in which, as in the Canidæ and the Ursidæ, a bone or baculum is present in the penis of the male, useful generic characters are afforded by this structure which have been emphasized by Thomas and by Pocock; other obvious adaptive characters of feet and teeth are made use of in the following key, which is based partly on the work of Pocock and of Miller. It includes nine genera whose occurrence is recognized in China and Mongolia; and these, following Pocock, constitute no fewer than five subfamilies.

In addition to these genera, it seems probable that *Gulo*, the wolverene, will also eventually be found to reach the forest and mountain country of

northern Mongolia, for Sowerby (1923g) mentions that he once saw a skin of one, said to have come from the "Urga district," and it occurs also in the forests of Manchuria. Nevertheless, in the lack of more definite evidence, I have not included it here.

Key to the Genera of Chinese and Mongolian Mustelidæ

A. Crown of upper carnassial (pm^4) somewhat Y-shaped with a long outer portion and an antero-internal lobe; upper molar wider than long.

a. Upper carnassial with a single small antero-internal lobe; feet non-fossorial, furred below, the pads small and claws short and curved for climbing or ground-living.

a′. With $\frac{4}{4}$ premolars ..... Martinæ (Martens)

1. Color varied black and yellow above, upper lip not divided by a groove..... *Charronia*
2. Color brown above, upper lip with a distinct vertical groove..... *Martes*

b′. With $\frac{3}{3}$ premolars..... Mustelinæ (Weasels, Stoats)

1. Color brown above (summer); lower carnassial (m_1) without metaconid; hamular process of pterygoid widely separated from auditory bulla. *Mustela*
2. Color above, spotted brown, on a yellowish-white ground; lower carnassial with a distinct metaconid; hamular process in contact with the bulla..... *Vormela*

b. Upper carnassial with a broad, bicuspid, inner lobe; feet fossorial, naked below, the claws long and slender..... Helictidinæ (Ferret-badgers)

a′. Tip of baculum trifid..... *Helictis*

B. Crown of upper carnassial obviously triangular in outline, the upper molar longer than wide.

a′. Feet fossorial, heavily clawed, toes not webbed; tail short, less than half the body length..... Melinæ (Badgers)

a′. Nose-pad separated from upper lip by a hairy area; auditory bullæ swollen, projecting; upper molar nearly rectangular in outline..... *Meles*

b′. Nose-pad continuing to upper lip as a naked area; auditory bullæ flattened, only slightly projecting; upper molar rhombic in outline..... *Arctonyx*

b. Feet natatorial, the toes webbed, claws small; tail strong, more than half the body length..... Lutrinæ (Otters)

a′. Toes with well developed claws, premolars four above..... *Lutra*

b′. Toes with minute claws, premolars three above..... *Micraonyx*

Genus **Charronia** Gray

Charronia Gray, Proc. Zool. Soc. London, 1865, p. 108 (subgenus of *Martes*). Pocock, Ann. Mag. Nat. Hist., ser. 9, vol. 1, p. 308, 1918.

Mustela Thomas, Proc. Zool. Soc. London, 1898, p. 771; and others.

Martes Thomas, *ibid.*, for 1908, p. 967, 1909; and others.

Lamprogale Ognev, Mém. Sect. Zool., Amis des Sci. Nat., Anthrop. et Ethnogr., Moscow, no. 2, pp. 26, 30, 1928.

This is one of the largest of the martens, with a long heavy body, long cylindrical tail, and a striking coloration of yellow and black. In most external characters it does not otherwise differ greatly from the more typical martens, but as shown by Pocock (1918) the structure of the baculum is highly characteristic. For, whereas in typical *Martes* it bends gradually upward in its distal third, with an expanded tip that ends in two short branches, a lower that is nearly straight, and an upper that arises on the right side of the base of the lower and curves obliquely forward to the left, in *Charronia* the bone is long, and at its tip curls abruptly upward to a nearly vertical position, and the extreme tip divides into four short processes. There are also slight differences in the lips, for the naked nose-pad is divided by a vertical groove in *Martes*, but in *Charronia* this division is not so obvious, so that the lips are less mobile. With *Martes*, this genus shares the unreduced number of premolars, four in each jaw; the molars, however, are reduced in number as in all the family, and consist of one above and two below (of which the second is very small), so that the tooth formula is: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{1}{2}$ = 38. The fourth upper premolar is trenchant, with an outer lengthwise blade whose main cusp is sharp and situated slightly ahead of the middle, while the inner anterior portion is reduced to a rounded cusp, low but distinct. The upper molar is about one and one-half times as wide as long, somewhat dumbbell-shaped, rounded at the inner and outer sides, with a slight constriction in the middle.

Ognev has lately proposed the generic name *Lamprogale* as a substitute for *Charronia*, on the ground that the latter is preoccupied by the earlier name *Charonia*, a genus of mollusks. A strict adherence to the "one-letter rule," however, would seem to render such a course unnecessary. There is apparently but a single well-defined form in the area under consideration, although from time to time various authors have sought to erect subspecies. This is the type species of the genus as well.

171. **Charronia flavigula flavigula** (Boddaert)

YELLOW-THROATED MARTEN

Mustela flavigula Boddaert, Elenchus Animalium, vol. 1, p. 88, 1785.

Mustela flavigula kuatunensis Bonhote, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 348, 1901.

Martes flavigula borealis Thomas, Proc. Zool. Soc. London, for 1908, p. 967, 1909 (part). G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 238, 1912 (not of Radde).

Mustela flavigula szetchuensis Hilzheimer, Zool. Anzeiger, vol. 35, p. 310, 1910.

Charronia flavigula Pocock, Ann. Mag. Nat. Hist., ser. 9, vol. 1, p. 309, fig., 1918. Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 395, 1922.

Mustela flavigula borealis Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 4, 1922 (part).

Charronia flavigula kuatunensis Cabrera, Bol. Real Soc. Esp. Hist. Nat., Madrid, vol. 22, p. 164, 1922. A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 25, 1929.

Charronia melli Matschie, in Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, pp. 17, 35, 1922.

Charronia yuenshanensis Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 9, p. 3, 1930.

Type specimen:—Not known to exist. The name is supposed to be based on the animal of Nepal.

Description:—A large species, as big as a full-grown house cat, but with legs proportionally shorter; the tail about as long as the trunk, cylindrical and not very thick. Color in winter: head from the muzzle to the outer base of the ears, the nape, forearms, fore feet, hind legs and tail brownish black; body above golden on the shoulders, passing into brown and black on the rump; chin to ears white, throat yellow, belly brownish gray. In summer slightly darker above and on the body below.

In a series of specimens, considerable variation is shown. The golden hue of the throat may vary in intensity, and an area of gold-tipped hairs may extend forward medially on the dark nape patch to the crown, making a clearer median area and dividing the patch. The posterior dark area usually extends forward as an ill-defined median stripe, which, especially in summer pelage, may be practically continuous from the nape or broken at the shoulders. A March skin from Szechwan is bright golden or ochraceous over the shoulders with a median stripe indicated by gold-tipped hairs with dark bases. A Tsingling skin has the yellow areas very pale, the middle dark ring of the shoulder hairs reduced. One from Szechwan has the longer hairs of the belly lightly tinged with brown, the head more intense black than brown. In summer skins from Fukien, and one from the western border of China, the coloration is darker, with smoky under fur above and the dorsal hairs generally darker with less of the clear yellow of winter, since this tint is confined to a small terminal portion; the belly, too, is less yellow, but pale brown or drab. In an unusually bright specimen taken in April in Fukien, the belly is golden and the shoulder area and sides an intense ochraceous.

Measurements:—An adult female from Fukien measured: head and body, 477 mm.; tail, 375; hind foot, 90; ear, 40. Sowerby gives the corresponding dimensions of an old male from southwestern Shensi as 577, 440, 103, 49.

Although but few measurements are available, adult males are probably on the average slightly larger than females and have heavier skulls.

CRANIAL MEASUREMENTS OF *CHARRONIA FLAVIGULA FLAVIGULA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth, c-m¹	Lower cheek teeth, c-m₂	Sex	Locality
38331	100.7	95.0	47.5	56.0	45.0	34.0	34.0	40.0	♂	Fukien
43148	99.0	91.7	48.0	55.5	44.5	31.8	32.8	38.7	♂	Yunnan
57046	99.5	90.5	45.5	58.7	46.0	36.8	32.4	39.0	♂	Shensi
9.1.1.16 BM	110.1	102.0	51.8	——	47.3	36.0	36.3	——	♂	Shensi
43147	91.5	84.5	42.7	48.5	43.0	30.3	30.8	35.7	♀	Yunnan
43149	94.2	87.8	44.4	55.0	43.2	32.0	32.2	37.2	♀	Yunnan
59317	89.2	82.0	40.6	52.2	39.7	29.0	29.1	34.5	♀	Fukien
84445	92.4	86.2	42.5	53.5	42.0	29.3	30.2	35.1	♀	Fukien
84447	——	91.3	50.4	65.0	48.2	34.0	34.8	40.0	♀	Fukien
84894	96.0	87.3	45.0	52.7	41.5	30.0	32.2	36.4	♀?	Szechwan
98.11.1.7 BM (type of *C.f. kuatunensis*)	91.7	84.7	41.6	51.3	42.1	29.0	30.3	35.9	♀	Fukien
2.6.10.27 BM	99.6	92.4	46.7	63.0	46.0	33.1	32.9	——	♂	Fukien

Nomenclature:—There seems to be a considerable amount of variation in color of an individual as well as of a seasonal nature, even in skins from the same area. This has led to the naming of several supposed races, which, however, appear to be quite indistinguishable from the typical race of the eastern Himalayas. Thence the range extends southeastward at least to Siam, where the race *C. f. indochinensis* was named, but Thomas has since shown that this is, after all, indistinguishable. The rather strikingly darker coloring of summer skins has undoubtedly led to the naming of at least two additional supposed forms. Thus Bonhote based his *Mustela flavigula kuatunensis* on a specimen taken in northwestern Fukien on May 6, and his description is that of the usual summer pelage with darker lower parts; winter skins from the same region are now available and are quite the same as those from Yunnan. The "darker underparts" also form the chief basis for Shih's *Charronia yuenshanensis*, based on a native skin from Yuen Shan, Hunan. Another native skin bought in Sungpanting was described by Hilzheimer as *Mustela flavigula szetchuensis*, on the ground that the pale brown of the head is paler, and the dark brown darker, almost black, as contrasted with *C. f. "borealis"* (= *C. f. aterrima* Pallas), the race of Amurland. The color differences are probably all individual or seasonal, and no doubt Jacobi (1922) is correct in regarding this as a synonym of typical *C. f. flavigula*, especially since other specimens from Szechwan are not separable. Likewise, Matschie's

C. melli from Kwangtung is apparently not different. It is a question whether or not *C. f. aterrima*, typical in Amurland, northeastern Siberia, should be included in the Chinese fauna. Sowerby (1923g) regards his Manchurian specimen as of that race, and different from animals seen in North China. A careful comparison of skins from the latter area with typical material from Amur is needed before this can be decided. A skin from the Tsingling Range, Shensi, which is rather pale in tint, is possibly tending toward the northern form. A. B. Howell (1929, p. 25) finds that two Manchurian pelts differ from each other fully as much as they do from Shensi individuals; one from Shansi is not greatly different from another from Fukien; a third from Yunnan is very dull, while a fourth from Szechwan is very bright. It seems very doubtful whether color characters can be found for the recognition of any but the typical form in China, although Howell suggests that a sufficient series of skulls might show that the Yellow-throated Martens of North and West China are separable into two forms. For the present, however, I have regarded all as of one race.

In a recent paper, Heptner (Folia Zool. et Hydrobiol., vol. 6, p. 24, 1934) has shown that the form of Amurland should be called *Charronia f. aterrima* (Pallas). This name was based on specimens of this species from between Uth and Amur Rivers, and was first published in Pallas's "Zoographia", vol. 1, p. 71, 1811, thus long antedating Radde's *borealis*, of 1862.

Occurrence and Habits:—In general the Yellow-throated Marten is an animal of wooded mountainous country, fairly well distributed over most of southern and central China south of the Gobi. I have no definite records of its occurrence in Hopei, where, perhaps, the country is too well cleared to attract it. To the southwest, however, it is common in the mountains as well as in the loess country of Shensi and Shansi, where Sowerby says it inhabits the deep ravines. A specimen from Taipai Shan, Shensi, was secured by Dr. Roy C. Andrews. In parts of Szechwan it must be fairly plentiful. Jacobi records specimens under *Mustela f. borealis* from the Wassu Mountains, Taukwan, and the mountains near Wanhsien in that province. In extreme western China, J. F. Rock secured a specimen for the Museum of Comparative Zoölogy, from Na Tebbuland, where it inhabits dense forests of poplar, maple, linden, spruces and firs. Southward it ranges throughout the forests of Yunnan, as at the Namting River, Burma border, and Likiang, whence the American Museum Asiatic Expeditions brought back a series. Others were secured in Fukien at the opposite eastern portion of China, by the Central Asiatic Expeditions, as well as by La Touche for the British Museum. Shih has recorded it from Hunan, and Mell regards it as not common in the wooded mountains of extreme southern China in Kwangtung. It is not known to occur in Hainan.

Mell (1922, p. 17), writing of Kwangtung, tells of two that were shot on the edge of an opening in the woods in early morning as they were snapping at bees going in and out of a hive; their stomachs contained the bees they had already caught. A male shot October 15 in a high tree in a village wood at Fungwahn, also had honey bees in its stomach, so that these are evidently a favorite food. Indeed, Sowerby (1923g) states that it is known in Manchuria as "mi-kou" or Honey Dog, although in Shansi and Shensi the Chinese call it "hwangyao" (Yellow Marten), in reference to its yellow color. A writer in the Journal of the Bombay Natural History Society (1916, vol. 24, p. 589) has mentioned its fondness for nectar, and another speaks of its running down fawns of the Barking Deer. Evidently its predaceous habits of diet are modified by a liking for sweets, but of its special animal food there seems to be little recorded for China.

Specimens examined:—In all, nineteen, as follows:

Fukien: Chunganhsien, 4; Futsing, 1; Yenping, 1; Kuatun, 2, including type of *kuatunensis* (B.M.).
Hupeh: 1 (M.C.Z.).
Shensi: Taipai Shan, 1; Yenanfu, 1 (B.M.).
Kansu: Na Tebbuland, 1 (M.C.Z.).
Szechwan: Wanhsien, 1; no locality, 1.
Yunnan: Likiang, 1; Namting River, Burma border, 4.

Genus **Martes** Pinel

MARTENS

Martes Pinel, Actes Soc. d'Hist. Nat. Paris, vol. 1, p. 55, 1792.

The genus *Martes* contains the sables and true martens, valuable fur-bearers of the northern hemisphere. They are short-limbed with well-developed ears and have fairly long tails, about half the length of head and body, which are full and almost bushy. The claws are rather slender, sharp and curved, adapted for tree-climbing. The colors are prevailingly rich brown with paler head and chest. The baculum is characteristically different from that of *Charronia*, in that it is gradually upturned in its terminal sixth, without the extraordinary sigmoid curvature observed in the *Charronia* baculum, and its tip, instead of being four-parted, is bifid. Probably two species occur sparingly along the northern border of Mongolia and northern China, the Sable and the Stone Marten. Possibly the Pine Marten also occurs, but positive information is lacking.

KEY TO THE CHINESE AND MONGOLIAN SPECIES OF *Martes*

A. Color brown; fore neck and throat colored like the body; tail half as long as head and body ..... *Martes zibellina sajanensis*

B. Color slate brown with light under fur; tail two-thirds the length of head and body ..... *M. foina*

172. **Martes zibellina sajanensis** Ogney

SAIANSK SABLE

Martes zibellina sajanensis Ogney, Journ. Mammalogy, vol. 6, p. 278, 1925.
Martes zibellina Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 392, 1912.

Type specimen:—A skin and skull, No. 9705, Zoölogical Museum of the Academy of Sciences, Leningrad, U.S.S.R., from the Orsyba River, northern part of the Sajan Mountains, Siberia.

Description:—The describer states that this animal has a markedly shorter skull than that from the Krasnojarsk district. The general color of the most common type is dark brown, the under fur of a light yellowish color. The throat patch varies in tint; in some specimens it is dusky, not differing markedly from the sides; in others it is brilliant salmon color.

The shortness of the skull is supposed to be the main diagnostic character.

Measurements:—The describer gives no external measurements. The skulls measure: total length, 83.2-84 mm. (males), 74 (females); zygomatic width, 47.5-50.2 (males), 43.6 (female); breadth of brain case, 36.2-37.4 (males), 33.5 (female).

Occurrence and Habits:—It is probably this form, slightly differentiated though it seems to be, that occurs in the mountain forests of northwestern Mongolia. Thomas (1912a, p. 392) records that Carruthers brought back two skulls from a fur-hunter's hut in the Tapsa Mountains in northwestern Mongolia. A sable occurs in Manchuria, but does not seem to extend much farther south.

Specimens examined:—None.

173. **Martes foina foina** (Erxleben)

STONE MARTEN

Mustela foina Erxleben, Syst. Regni Animalis, Mammalia, p. 458, 1777.

Type specimen:—Not known to be in existence. The type locality is taken as Germany.

Description:—Somewhat similar to the Sable, but the fur usually has a slaty cast, a light under fur and a white throat patch, varying to buffy. The relatively longer tail, about two-thirds the head and body, also serves to distinguish it.

Measurements:—No measurements of Chinese specimens are available. Miller (1912) gives the following for European specimens: adult male, head and body, 453 mm.; tail, 260; hind foot, 85; ear, 34. Skull: male, condylo-

basal length, 84 mm.; zygomatic width, 52; mastoid width, 39; maxillary tooth row, 30; mandibular tooth row, 35.

Occurrence and Habits:—Little is recorded of this species in China and Mongolia. It probably occurs in evergreen forests and rocky country of Mongolia along the northern border of the Gobi, and in similar country "through Northern Chihli, Shansi, and into West China" (Sowerby, 1923g, vol. 2, p. 66). Sowerby states that he has seen large consignments of skins from northern Shansi and from Mukden, and can detect no difference between them. Jacobi (1922) mentions a summer skin, half-grown, obtained by the Weigold Expedition in Sungpan in which the white chin was reduced to a small mark on the lower jaw. How far south its range extends is not clear, but probably not much beyond the broken country of northern Shansi, and northern Szechwan.

It is not clear whether the eastern Stone Marten is subspecifically different from that of Europe. Possibly it is the same as *M. f. kozlovi* Ognev.

Specimens examined:—None.

Genus **Mustela** Linnæus

Mustela Linnæus, Syst. Nat., ed. 10, vol. 1, p. 45, 1758.

The members of this genus agree in having a slender body, short legs, and the tooth formula: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{1}{1}$ = 34, that is, with one less premolar in each jaw than the martens, with which formerly they were associated. The lower carnassial tooth (m_1) is more specialized than in the tiger weasels (*Vormela*), in that the metacone is entirely lost, and the tooth, therefore, more knife-like in its sharp blade for shearing against the inner edge of the last upper premolar. The snout is much shortened, so that the distance from the orbit to tip of muzzle in the skull is less than the distance across the antorbital foramina. The genus contains a number of species, most of which are of boreal distribution. Several distinct types are represented, to which from time to time various generic or subgeneric names have been given, but the conservative usage seems to be to regard these as constituting subgenera. Of the species occurring in China and Mongolia, the typical subgenus *Mustela* is represented by the stoats with black tail-tufts (of which the European Stoat, *M. erminea*, is the type), and the dwarf weasels, sometimes placed in a separate subgenus, characterized by the very short tail, and lack of a black tail-tuft; for the eastern weasels without black tail-tuft, the subgenus *Kolonokus* has been proposed; the polecats or ferrets are larger and more heavily built, with angular mastoid region, and constitute the subgenus *Putorius*, characteristic of rather open steppe country. The true minks are modified in the character of the fur for a partly aquatic life and have a rather broad, flattened brain

case; they constitute the subgenus *Lutreola*, which, however, is not known to occur in the area here considered.

FIG. 17. Distribution Map.

Mustela

1. *M. sibirica fontanierii*
2. *M. sibirica davidiana*
3. *M. sibirica moupinensis*

KEY TO CHINESE AND MONGOLIAN SPECIES OF *Mustela*

A. Color of under side not sharply contrasted with that of back.
  a. Tip of tail usually not darker.
    a′. Color paler fulvous..... *M. sibirica fontanierii*
    b′. Color darker and richer, ochraceous-orange..... *M. sibirica davidiana*
  b. Tip of tail darker, smoky brown..... *M. sibirica moupinensis*

B. Color of under side contrastingly different from that of back.
  a. Tip of tail not black.
    a'. Tail at least three times longer than hind foot.
      a''. Paler, lower side pinkish, toes whitish..... *M. altaica altaica*
      b''. Darker, lower side yellow, toes dark..... *M. altaica kathiah*
    b'. Tail much less than three times longer than hind foot.
      a''. Very small, white below, tail about equaling hind foot in length..... *M. rixosa pygmæa*
      b''. Yellow below, tail about twice the hind foot..... *M. russelliana*
  b. Tail tip conspicuously black.
    a'. Feet brown like back in summer, in winter white..... *M. erminea mongolica*
    b'. Feet black, contrasting with back..... *M. eversmanni tiarata*

In 1911 the Russian zoologist Satunin gave the subgeneric name *Kolonokus* to the eastern weasels of the *Mustela sibirica* group, and Ognev has later (1931) placed those of the *altaica* series in the same group, after which he proceeds to use the name in a generic sense. Very likely the two species with their various races are to be considered as thus closely allied, and at least the separation seems more natural than that usually followed of placing them in the mink group, as *Lutreola*. These weasels are lacking in modification of the coat for aquatic habits, and the long tails are without the black tip seen in the typical stoats, which they resemble in habits.

174. **Mustela sibirica fontanierii** (Milne-Edwards)

Putorius fontanierii Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 205, pl. 61, fig. 1, 1868-74.
Mustela sibirica Swinhoe, Proc. Zool. Soc. London, 1870, pp. 238, 624 (in part).
Arctogale fontanieri Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 147, 1908.
Lutreola stegmanni Matschie, *ibid.*, p. 150.
Lutreola sibirica Thomas, Proc. Zool. Soc. London, 1911, p. 688.
Mustela sibirica fontanieri G. M. Allen, Amer. Mus. Novitates, no. 358, p. 3, 1929.
Mustela sibirica sibirica A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 26, 1929.

Type specimen:—This race was described as a full species on the basis of a skin, without skull, sent to the Muséum d'Histoire Naturelle at Paris, from Peiping, by M. Fontanier, the French honorary consul stationed there. It is figured in color by Milne-Edwards, and is presumably still in Paris.

Description:—Form weasel-like, with long body and short limbs, the tail rather bushy and about two-fifths the length of head and body. Color a uniform pale fulvous, slightly paler below; forehead and muzzle pale brown, the upper lip around the nose-pad, and the chin, white. There are often white marks in the center of the throat and neck, sometimes ill-defined and of varying extent. In fresh winter pelage, the body color is very pale, about pinkish cinnamon of Ridgway above, paling to cinnamon buff below, the tail slightly more intense in color, about orange cinnamon. The Yellow Weasel of eastern China, although of light coloration, is markedly darker than two

winter skins assumed to represent typical *sibirica*, from near Lake Baikal (type locality, near the Yenessei River, Siberia). Radde (1862) also mentions that specimens from the Amur region are larger and darker than Baikal animals. It seems certain, therefore, that the race of eastern China is quite distinct, and is obviously the one figured and named by Milne-Edwards. His description applies well to a female in pale winter pelage, while the dimensions of the specimen as given are nearly identical with those of a female from Shansi.

Measurements:—Males are somewhat larger than females, as the following collectors' data show.

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
32264	310	180	52	28	♂	Shensi
32266	320	200	61	25	♂	Shensi
45350	380	225	68	28	♂	Shensi
32265	260	179	48	22	♀	Shensi
45353	290	170	54	20	♀	Shansi
45354	280	198	55	20	♀	Shansi

CRANIAL MEASUREMENTS OF *MUSTELA SIBIRICA FONTANIERII*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Mas-toid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
32264	61.5	57.0	28.1	30.5	27.8	19.2	18.4	22.0	♂	Shensi
32266	61.8	57.2	28.0	32.4	28.2	19.5	19.5	22.0	♂	Shensi
32267	60.3	56.0	27.0	31.6	27.0	18.5	18.0	21.3	♂	Shensi
45350	68.3	63.2	31.5	36.7	32.2	20.5	18.1	23.5	♂	Shansi
60095	65.0	60.0	29.0	35.0	29.5	18.8	18.0	20.6	♂?	?
19895 MCZ	66.4	63.0	30.0	35.8	31.2	20.3	19.0	22.9	♂	Shansi
32265	54.0	49.6	23.2	27.0	23.5	16.0	15.2	18.5	♀	Shensi
45353	56.0	52.0	23.5	28.2	24.5	18.2	16.0	19.1	♀	Shansi
45354	55.0	51.7	24.0	29.2	24.7	17.6	15.8	19.2	♀	Shansi
2.6.10.30 BM	54.3	51.0	24.1	27.3	24.3	17.0	16.9	19.1	♀	Kiangsu

No. 45353 from Kweihwacheng, Shansi, has the tip of the tail indistinctly darker, as does also No. 32265 from Fengsiangfu, Shensi, showing thus a certain intergradation in this character between the typical condition and that of *M. s. moupinensis* with the decidedly dark-tipped tail. Other specimens from the same localities do not have the dark tip.

Occurrence and Habits:—As a species this weasel is widely distributed from Siberia and the Amur region, southward to the latitude of Amoy and westward into the highlands of the eastern Altai, except in the Gobi. It seems to break up readily into geographic races, that of the cold northern part of the range representing typical *M. sibirica*, with paler coloring and longer, thicker fur in winter than the darker race of North China, *M. s. fontanierii*. In western China a well-defined race of still darker coloring and a contrasting dark tail-

tip is represented by *M. s. moupinensis*, while in response to warmer climatic conditions, the race of southeastern China is still brighter, *M. s. davidiana*. Sowerby (1923g) writes that the Manchurian form is different from that of North China, with longer fur and a grayer face (*M. sibirica manchurica* according to A. B. Howell). He adds that they occur everywhere, "in towns, in marshes, on dry plains, and in the forest." On his expedition with Clark to western Shensi, he trapped two in a drain of a temple yard at Liutsun, fifteen miles south of Hsianfu, and regards them as common all over North China, especially in large towns where they seem to thrive on the abundance of rats and vermin. They come boldly into houses, pursuing the rats inside the walls. A specimen was killed chasing chickens at Fengsiangfu, Shensi, by one of the members of the Central Asiatic Expeditions. The native name is "huang shu lang" or Yellow Rat Wolf. The American Museum Asiatic Expeditions secured specimens from various localities in North China that seem to represent but a single form, from Chimo, Shantung, westward as far as Shensi, about forty-five miles south of Fengsiangfu. Southward it probably occurs as far as the Yangtze basin before intergrading with the southeastern race.

Matschie (1908) gave the name *Lutreola stegmanni* to four summer skins sent from the vicinity of Tsingtao, Shantung, stating that, although they agreed strikingly with Milne-Edwards's figure of *P. fontanierii*, the tail was colored like the back, and the white marking on the chin was small. There can be no doubt, however, that these are matters of individual variation and that the Shantung specimens are inseparable from *M. s. fontanierii*.

Specimens examined:—In all, eighteen, as follows:

Shantung: Chimo, 1.

Shansi: Kweihwacheng, 5; Taipai Shan, 2 (skulls); Taiyuanfu, 2.

Shensi: forty-five miles south of Fengsiangfu, 4; Shangchow district, 1 (B.M.); Singanfu, 1 (B.M.).

Kiangsu: Shanghai, 2 (B.M.).

175. **Mustela sibirica davidiana** (Milne-Edwards)

Putorius davidianus Milne-Edwards, in David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 92, footnote, 1871. Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 343, pl. 59, fig. 1; pl. 60, fig. 2; 1868-74.

Mustela sibirica Swinhoe, Proc. Zool. Soc. London, 1870, pp. 238, 624 (in part).

Putorius sibiricus noctis Barrett-Hamilton, Ann. Mag. Nat. Hist., ser. 7, vol. 13, p. 390, 1904.

Lutreola davidiana J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 430, 1909.

Lutreola melli Matschie, in Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 35, 1922.

Mustela sibirica davidana (sic) G. M. Allen, Amer. Mus. Novitates, no. 358, p. 4, 1929.

Type specimen:—The type of Milne-Edwards's *Putorius davidianus* was a female specimen with skull, sent from Kiangsi, southern China, by Père Armand David. It is presumably still in the Muséum d'Histoire Naturelle at Paris.

Description:—The Yellow Weasel of southeastern China is much more

intense in its coloration than that of northern China (*M. s. fontanierii*), almost "ochraceous orange" of Ridgway (1912) in fresh winter pelage, the tail of the same tint as the back. In summer pelage the central area of the back is slightly darker, having a wash of reddish brown. The lower side is only slightly paler than the back. The forehead and muzzle as far back as the eyes are dark blackish brown, the fore feet tinged with the same. A varying amount of white includes the edge of the upper lip at the side of the nose-pad, the lower lips and chin, or the entire interramal area, and extends as a narrow and more or less broken median line on to the throat.

The skull is not distinguishable from that of the North China race, although Milne-Edwards, in describing the race *P. davidianus*, based it chiefly on differences in size as compared with a skull representing the same animal from Amoy! Milne-Edwards apparently was quite unaware of the sexual difference in size and evidently compared his female skull with that of a male from Amoy. The more swollen forehead was perhaps due to the presence of filariæ in the frontal sinuses, an infection often found in weasels.

Measurements:—The available measurements of specimens in the flesh are:

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
44574	370	105	55.0	—	♂	Fukien
85035	304	204	62.5	32	♂	Fukien
7104 MCZ	365	200	70.0	—	♂	Hupeh
7105 MCZ	390	195	65.0	—	♂	Hupeh
7107 MCZ	400	200	70.0	—	♂	Hupeh
44573	325	115	45.0	—	♀	Fukien
7106 MCZ	323	172	50.0	—	♀	Hupeh
PARIS (type)	290	160	——	—	♀	Kiangsi

CRANIAL MEASUREMENTS OF *MUSTELA SIBIRICA DAVIDIANA*

No.	Condylobasal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
45501	60.3	56.0	26.2	30.3	26.5	18.1	17.3	21.0	♂	Fukien
85035	62.0	58.0	28.2	31.0	26.5	18.3	18.0	21.8	♂	Fukien
7104 MCZ	65.5	61.7	29.0	34.7	30.7	21.0	19.0	22.9	♂	Hupeh
7105 MCZ	66.0	61.5	30.2	34.3	30.7	19.5	18.6	——	♂	Hupeh
94.9.1.4 BM	62.6	——	28.5	32.4	27.2	19.4	18.5	21.6	♂	Fukien
44573	51.0	——	22.6	25.5	——	15.8	14.8	17.5	♀	Fukien
PARIS (type)	52.0	——	——	——	——	——	——	——	♀	Fukien
7106 MCZ	55.5	51.5	24.4	27.0	23.5	16.5	15.5	18.4	♀	Hupeh
99.3.1.11 BM (type of *P. s. noctis*)	60.2	——	26.0	31.5	26.7	18.6	17.8	21.1	♂	Fukien
8.7.25.15 BM	55.5	——	23.9	28.0	23.7	16.3	15.8	18.5	♀	Fukien

Nomenclature:—Milne-Edwards, after some hesitation, described this as a distinct species, comparing the cranium of his female specimen, from Kiangsi, with a skull, evidently of a male, sent him from Amoy, in the neighboring province of Fukien, and taken to represent typical *M. sibirica*. Nevertheless, his colored plate shows well the bright coloring and uniform tail of the subspecies of southeastern China. The race described by Barrett-Hamilton as *Putorius sibiricus noctis* from "Sanyentze" or Sanyuen, in central Fukien, is obviously the same, nor does it seem that Matschie's *Lutreola melli*, based on a specimen from "Tsähpei," in the Canton region, is really different, its chief diagnostic character, according to its describer, being the possession of a longer tail. But this member varies more or less, as may be seen by the table of measurements.

Occurrence and Habits:—As elsewhere, this is a common species about towns, in southeastern China, pursuing rats even in the walls of the houses. Swinhoe says it also kills and eats snakes, while according to Mell (1922) it is said to prey upon birds at times. He found it in the flat rolling country about Canton, where it is rocky and sparsely covered with bushes. Mr. Clifford H. Pope, however, found it uncommon about Futsing in 1925, for with much hunting on the surrounding plains, only one was seen and secured. Heller and Dr. Andrews nevertheless secured a small series there in 1916.

The range is extensive, from about the latitude of Shanghai westward up the Yangtze valley to the Ichang Gorges and the eastern edge of the highlands, thence over the low country of southeastern China at least to Canton and Kwangsi Province. It does not reach Hainan, nor apparently does it extend quite to the southern border of the mainland provinces neighboring. Howell (1929) has recorded specimens in the U. S. National Museum from Shanghai, Kiangsu; Taipingfu, Anhwei, as well as from Yochow, Hunan. There are typical specimens in the Museum of Comparative Zoölogy from the neighborhood of Ichang, Hupeh, and Shih (1930b) has reported it from the southwestern border of Hunan. Dr. J. A. Allen (1909a, p. 430) recorded a male from "Si-Taipa-Shiang" in southern Shensi, which perhaps marks nearly the northwestern boundary of its range, and the meeting place with the race *M. s. fontanierii* of North China and the western subspecies *M. s. moupinensis*.

Specimens examined:—In all, twenty, as follows:

Fukien: Futsing, 7; Foochow, 2 (B.M.).
Hupeh: Ichang, 4 (M.C.Z.); Ching River, 1; Changyang, 1 (B.M.).
Kiangsi: Hokou, 1.
Kiangsu: Soochow, 1; Nanking, 2 (Univ. Mich.); 1 (Univ. Mich.).

176. **Mustela sibirica moupinensis** (Milne-Edwards)

Putorius moupinensis Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 347, pl. 59, fig. 2; pl. 60, fig. 4; 1868-74 (1872).

Lutreola moupinensis J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 430, 1909.
Lutreola major Hilzheimer, Zool. Anzeiger, vol. 35, p. 310, 1910.
Lutreola tafeli Hilzheimer, *loc. cit.*
Lutreola sibirica moupinensis Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 395, 1922.

Type specimen:—The original specimen was sent to the Paris Museum by Père Armand David, who obtained it in the mountains of Muping, west-central Szechwan.

Description:—This is a subspecies of the western Chinese highlands. It differs from the others previously treated in its darker color and a contrasting dark tail-tip. The latter character is sometimes indistinctly seen in *M. s. fontanierii*, but is better developed in the present race, in which it forms a well-defined terminal blackish area a half-inch or more long. The general color of the body and tail is fulvous in winter, slightly paler below, and the brown mask on the face indistinct and confined mostly to the muzzle in front of the eyes. In summer pelage the general color is much darker, the entire dorsal surface of the body browner, and the facial mask darker, blackish brown, this color extending back over the mid-dorsal area, and passing into a more fulvous tint at the sides.

The skull and teeth are essentially as in the other races, the female being slightly smaller.

A skeleton has fourteen pairs of ribs, of which ten or eleven articulate directly with the sternum; there are six lumbar, three sacral, and twenty-two caudal vertebræ. The tip of the baculum is hooked in a characteristic manner in this genus, with the end bent upward sharply.

Measurements:—The following collectors' measurements seem to show about the same size variations as in the other races.

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
58277	356	193	65	28	♂	Szechwan
58278	345	195	62	27	♂	Szechwan
56939	335	215	60	26	♂	Szechwan
7834 MCZ	345	198	59	—	♂	Szechwan
43171	235	135	43	23	♀	Yunnan
7835 MCZ	272	156	37	—	♀	Szechwan
7836 MCZ	265	167	49	—	♀	Szechwan

CRANIAL MEASUREMENTS OF *MUSTELA SIBIRICA MOUPINENSIS*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Mas-toid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
56939	61.7	57.6	29.0	31.8	28.3	18.2	17.2	21.0	♂	Szechwan
58278	62.2	58.0	27.2	32.0	29.0	18.6	18.4	22.0	♂	Szechwan
7834 MCZ	63.7	58.0	27.9	33.6	30.5	19.0	19.0	22.8	♂	Szechwan
23261 MCZ	——	47.0	23.0	27.0	23.0	16.2	14.7	17.4	♀	Kansu
28088 MCZ	——	——	25.3	30.5	26.6	17.3	16.2	19.8	♂	Yunnan

Nomenclature:—This is a well-marked race, with dark color corresponding to the cooler, moister habitat in western China. There is no doubt that the names *Lutreola major* and *L. tafeli* proposed by Hilzheimer on the basis of trade skins bought at Sungpan, northern Szechwan, are synonyms. He states that, in both, the tail tip is dark blackish brown (the main point of distinction for *L. tafeli*), and the description shows that the type of *L. major* was probably a male in the paler winter pelage.

Occurrence and Habits:—This darker race with the contrasting blackish to blackish-brown tail-tip is found over western Chinese highlands from the eastern borders of Szechwan westward into eastern Tibet (Weigold, 1923) and southward probably to the Burmese frontier in the hill country. It may be questioned if Thomas's *M. hamptoni*, from Imaw Bum, northern Burma, is really different, for as Thomas himself later admits, it should have been compared with this weasel rather than with *M. subhemachalana* as was originally done. A perfectly typical specimen from Lieuhoa Shan, in spruce forest at 10,000 feet, is the only one I have seen from southern Kansu (in the Museum of Comparative Zoölogy). From northern Szechwan it has been recorded by Hilzheimer (as *Lutreola major* and *L. tafeli*) from near Sungpan, and A. B. Howell mentions skins in the U. S. National Museum from there as well as from Suifu in the Yangtze valley of the southeastern part of the province. Dr. J. A. Allen (1909a, p. 430) identified as of this race two specimens from Yumonko, at the foot of Taipai Shan on the borders of Szechwan and Shensi. These points seem to mark about the northern and eastern limits of the race, but to the southwestward it has been recorded by Thomas, from Yunnan, in the Mekong valley, 7,000 feet, and from the Likiang Range, 27° 30′ north, at an altitude of from 11,000-14,000 feet.

Howell mentions that among the skins in the U. S. National Museum those from October to December are of the dark summer type, but possibly there was a mistake in recording the date of purchase as that of capture. At all events, skins in the collections I have examined show summer pelage September 20 and 17 (Wa Shan and Tachiao, Szechwan) and winter pelage in the case of two taken respectively October 28 (Wa Shan) and February 17 (Wanhsien).

A specimen taken on the Likiang Range had the remains of a *Microtus* in its stomach.

Specimens examined:—In all, twenty, as follows:

Szechwan: Wanhsien, 6; Wa Shan, 2 (M.C.Z.); Tachiao, 1 (M.C.Z.); Merge, 1 (A.N.S.P.); Tatsienlu, 1 (A.N.S.P.); Wenchwan, 1 (A.N.S.P.); no exact locality, 2 (A.N.S.P.).
Yunnan: Likiang Range, 2 (B.M.); 12,000 feet, 1; 7,800 feet, 1 (M.C.Z.); Talifu, 1.
Kansu: Lieuhoa Shan, 10,000 feet, 1 (M.C.Z.).

177. **Mustela altaica altaica** Pallas

ALPINE WEASEL

Mustela altaica Pallas, Zoographia Rosso-Asiatica, vol. 1, p. 98, 1811; vol. 1, p. 98, 1831 ed.
Mustela alpina Gebler, Mém. Soc. Imp. Naturalistes, Moscow, vol. 6, p. 212, 1823.
Putorius alpinus Trouessart, Cat. Mamm. Viv. Foss., p. 277, 1897.
Mustela astuta Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 400, 1912.
Kolonocus alpinus Satunin, Conspectus Mammalium Imp. Ross., p. 126, 1914.
Kolonocus alpinus alpinus Ognev, Mammals of Eastern Europe and Northern Asia, vol. 2, p. 728, 1931 (in Russian).

Type specimen:—The type is probably in Moscow and was from the Altai Mountains, Siberia. Gebler's name, *Mustela alpina*, usually employed for this weasel, proves to be antedated by *M. altaica* of the 1811 printing of Pallas's work quoted above.

Description:—The adult male of this weasel is about the size of a female *M. sibirica*, but is at once distinguished by its lower surface being contrastingly paler than the back, with a sharp line of demarcation.

In winter pelage, the entire upper parts from the nose to the ears and including the entire back and basal half of the tail are cream buff, slightly darkened with pale brown on the forehead and mid-dorsal area, paling on the sides of the body and terminal half of the tail to clearer cream buff. Cheeks tawny-ochraceous. Upper lip, chin and upper throat white, with a small dash-like mark of tawny ochraceous just behind the angle of the mouth. Fore feet all around to the wrist, and the backs of the hind feet, to a varying amount, clear white. Throat, chest and entire under parts of the body and the under side of the humerus and of hind legs to the ankle, pale straw yellow, slightly deeper in tint at the throat, and mixed with longer all-white hairs at the axilla, the entire area of yellow rather clearly defined along the sides of the throat and body. Tail of nearly uniform color all around, but slightly paler tawny ochraceous at the tip and below. In summer, the coat is much darker, a nearly uniform clear tawny above, very slightly darker on the forehead and in the mid-dorsal area. The upper lip, chin and upper throat are white, with the usual dark spot on each side behind the angle of the mouth. The legs are a little browner than the back, this color extending to the backs of the feet, but the toes and inner side of the wrists of the fore feet are white, as are also the toes of the hind feet. The remainder of the under side from upper throat to anus and inside of the limbs is pale orange or ochraceous buff somewhat mixed with longer white hairs. The amount of white on the feet varies even on opposite sides of the same specimen, but is usually more extensive on the fore feet, involving the inner side of the wrists nearly to the elbow, while in the hind feet the tips only of the toes may be white or this may extend along the side of the foot to the heel.

The skull is smaller than that of *M. sibirica*, but rather similar.

Measurements:—Few flesh measurements are available. The following include, however, those of an adult female from the Altai which is thus a virtual topotype, as well as those of two in the British Museum from Kansu.

No.	Head and body	Tail	Hind foot	Ear	Locality
25963 MCZ	249	103.5	36	—	Mongolia
12.8.5.24 BM	235	135.0	42	23	Kansu
12.8.5.25 BM	239	145.0	44	23	Kansu

Males are slightly larger than females. The two from Kansu, whose dimensions are given above, are both males.

CRANIAL MEASUREMENTS OF *MUSTELA ALTAICA ALTAICA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
25963 MCZ	45.0	42.0	19.6	22.5	20.5	14.0	13.8	15.3	Mongolia
23262 MCZ	——	46.0	22.3	24.5	22.2	14.8	15.2	17.5	Kansu
23912 MCZ	47.0	43.5	20.5	——	——	13.5	14.3	16.2	Kansu
12.8.5.24 BM	49.6	46.1	21.6	23.7	21.1	14.8	14.8	17.0	Kansu
12.8.5.25 BM	50.0	46.8	22.0	——	21.0	——	15.0	17.3	Kansu

Occurrence and Habits:—The Alpine Weasel is a species of the eastern parts of Tibet and the Altai region, ranging into western China from the mountainous parts of Kansu, eastward as far at least as western and central Shansi where Sowerby (1923g) has taken it, seventy miles northwest of Taiyuanfu. Possibly it extends still farther along the southern border of the Gobi, or passes to the northward, for Radde found it common in Transbaikalia, and Thomas in 1909 recorded it from the Khingan Mountains of western Manchuria.

Two specimens in the Museum of Comparative Zoölogy seem indistinguishable from a third taken in the Altai region, on the Kainda River. All three are in the pale winter pelage, which may perhaps be assumed rather early in the season, for one is dated (? late) "August," from the Lieuhoa Shan, southern Kansu, 10,000 feet altitude, a second in November from the Richthofen Range, 9,000 feet. Three others are in the darker summer coat, one from the Min Shan, 11,000 feet, in August, a second from Na Tebbuland in September, and a third from the Richthofen Range in October. These specimens are from high country, ranging from 9,000 to 12,000 feet above the sea. The females are obviously smaller in body than the males, but unfortunately the available skulls are not sufficiently comparable to bring out this contrast. From the lack of specimens in various collecting areas, one may infer that this weasel does not occur in the Gobi, although perhaps reaching the western edge of that region in the mountains. J. F. Rock secured specimens from the Richthofen Range in northwestern Kansu, in 1925, and traced it thence southeast-

ward into the mountains of southern Kansu near Choni, where also it has been found by the missionary Robert B. Ekvall. Except for Sowerby's record from western Shansi, no one seems to have found it in North China or in Mongolia. One was secured near Sungpan, northwestern Szechwan, by the Brooke Dolan Expedition, 1931. To the southward, in the more saturate highlands of Szechwan, it merges into the darker race, which apparently should be called *M. a. kathiah*. Milne-Edwards (1868-74, p. 345) suggests that it may be a race of his *Putorius fontanierii*, but overlooks its close relationship to his *P. astutus*, described on the same page, from Muping. No doubt it is this weasel that Buechner (1892) intended by *Putorius subhemachalanus*, applied by him to skins bought in the fur market at Ssigu, Kansu, by Berezovski. The latter said that it was a species of the undergrowth of the alpine zone, at times descending to the tree zone on the mountains. Probably Hilzheimer's *Arctogale tsaidamensis* from the Tsaidam Mountains, western Koko Nor, is the same. Mention should also be made of Ognev's *Kolonocus alpinus raddei*, type from near the lake, Tarei Nor, just across the northeastern boundary of Mongolia, in southeastern Transbaikalia. It is said to be distinctly brighter in winter, and of a darker brown tint in summer, than true *M. a. altaica*. No doubt it will be found eventually to extend across the border into Mongolia.

Little seems to be recorded of the habits of this weasel. Probably it lives in part upon the mouse-hares of the alpine heights, as the southern form is said to do. J. F. Rock found them not only at the higher altitudes, but also in forest country as low as 8,500 feet.

The specimen secured by Sowerby northwest of Taiyuanfu, Shansi, and now in the U. S. National Museum, is a skin without skull, perhaps of native preparation. It is a yellower brown along the sides than the average of *M. altaica*, but is quite closely matched by a skin in the Museum of Comparative Zoölogy from western Kansu, itself differing from other Kansu specimens in the same way. Apparently the yellower tint is, therefore, an individual peculiarity.

Anderson notes on the label of one of the specimens he secured near Taochow, Kansu, that it was seen chasing a pheasant, which it killed, and was shortly after itself trapped, the pheasant's head being used as bait. The locality was among growing crops.

Specimens examined:—In all, fifteen, as follows:

Kansu: Choni, 3 (M.C.Z.); Lieuhoa Shan, between Taochow and Titoa, 1 (M.C.Z.); Min Shan, 1 (M.C.Z.); Richthofen Range, 2 (M.C.Z.); Na Tebbuland, 2 (M.C.Z.); forty miles west of Sining, 1 (U.S.N.M.); southeast of Taochow, 2 (B.M.).

Shansi: seventy miles north-northwest of Taiyuanfu, 1 (U.S.N.M.).

Szechwan: Sungpan, 1 (A.N.S.P.); no locality, 1 (A.N.S.P.).

178. **Mustela altaica kathiah** Hodgson

YELLOW-BELLIED WEASEL

Mustela (Putorius) kathiah Hodgson, Journ. Asiatic Soc. Bengal, vol. 4, p. 702, 1835.
Putorius astutus Milne-Edwards, in David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 92, footnote, 1871. Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 345, pl. 61, fig. 2; pl. 60, fig. 3, 1868-74.
Putorius auriventer Trouessart, Bull. Mus. d'Hist. Nat., Paris, vol. 1, p. 235, 1895.
Putorius dorsalis Trouessart, *ibid.*, p. 236.
Ictis kathiah Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 6, 1922.
Arctogale melli Matschie, in Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, pp. 17, 35, 1922.
Mustela kathiah Weigold, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 2, p. 73, 1923.
Kolonocus alpinus astutus Ognev, Mammals Eastern Europe and Northern Asia, vol. 2, p. 735, 1931 (in Russian).

Type specimen:—Hodgson described this species from Nepal, and his type is in the British Museum.

Description:—Similar in proportions to typical *M. a. altaica*, the tail slightly more than half the length of head and body. Color in summer, a uniform dark brown, nearly chocolate brown, above including the tail all around, lacking the slight yellowish tinge of the northern race, *M. a. altaica*. Upper lip narrowly bordered with white, the anterior part of the chin white; throat and entire under surface of the body, including the inner sides of the fore legs to the wrists and of the hind legs to the ankles, ochraceous, without the pinkish tinge seen in *M. a. altaica*. Fore feet with the toes and sides of the wrist sometimes white, the hind toes the same. The winter pelage similar but slightly paler.

Measurements:—Two males from Fukien measured, respectively, head and body, 260, 270 mm.; tail, 136, 170; hind foot, 20, —.

CRANIAL MEASUREMENTS OF *MUSTELA ALTAICA KATHIAH*

No.	Condylobasal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
44711	52.5	49.0	22.8	27.5	23.4	15.9	15.3	17.7	♂	Fukien
44575	51.8	48.4	22.0	——	22.2	15.5	15.2	17.5	♂	Fukien
60195	55.0	50.4	24.0	28.0	23.4	16.3	16.1	15.7	♂	Fukien
85036	51.0	47.5	21.3	26.0	21.5	15.5	15.0	17.8	♂	Fukien
43172	41.3	38.0	16.8	21.0	20.3	12.2	12.2	13.8	♀	Yunnan
43171	49.4	46.0	21.5	25.3	22.2	15.1	15.0	17.5	♀	Yunnan
45502	52.5	48.4	22.6	26.0	22.2	16.0	15.1	18.0	♀?	Fukien
43.1.12.14 BM (type)	47.0	42.9	19.8	——	21.5	14.2	14.5	——	—	Nepal

The skull differs from that of *M. erminea* in the much narrower and more parallel-sided post-dental portion of the palate. The shape of the interpterygoid fossa is also slightly different, narrowing forward almost in a V-shape, instead of a U-shape. In the skull of an adult male there is a very low sagittal ridge.

Nomenclature:—There seems to be no doubt that Milne-Edwards's *Putorius astutus* from the high mountains of Muping, Szechwan, is the same as Hodgson's *M. kathiah*, or at most an intermediate between that and typical *M. a. altaica*. He mentions that its fore feet are white on their upper surface and so figures them in his plate, but in two specimens from Yunnan this is not the case, nor apparently is it in Nepalese specimens, though Hodgson mentions one from western India that had partly whitish feet. This character seems more typical of true *M. a. altaica*. No doubt there may be a slight variation in this matter. For the reason that the Yunnan and Nepalese weasels seem to be at least usually without white on the feet, I have regarded Matschie's *Arctogale melli* of southeastern China, type from Kwangtung, as a synonym of *M. a. kathiah*. A series from Fukien likewise shows no white markings on the feet. Trouessart (1895) considered Fukien specimens to represent *Putorius auriventer* (=*kathiah*), but others sent by M. Biet from Tatsienlu, Szechwan (Hsikang), presumed to be winter skins, he thinks sufficiently different to be given the rank of a separate species or race, which he named *P. dorsalis*, apparently not realizing that *P. astutus* was the same thing, described twenty years before.

Occurrence and Habits:—The distribution of this weasel and its races parallels in a way that of *M. sibirica*, regarded by Ognev as closely related. Both range over eastern Asia from the Altai and Transbaikalian country south to subtropical conditions in southeastern China, and west into the eastern edge of the Himalayas. The chief difference seems to be the apparent absence of a representative of *M. a. altaica* in northeastern China.

No doubt intergradation takes place between the typical race of *M. a. altaica* and *M. a. kathiah* somewhere in northern Szechwan. Jacobi (1922, p. 6) records two specimens from Sungpan, northern Szechwan, as representing the latter, as well as a third from Batang. Weigold, who secured these specimens, says it lives in the dwarf-tree zone at 3,800 to 4,500 meters altitude, where boulder-strewn slopes are covered with rhododendron; it preys upon alpine mice and mouse-hares. The American Museum Asiatic Expedition secured a single specimen at 9,000 feet on the Likiang Range in northern Yunnan. Eastward the species seems to extend across South China in mountainous country, to Fukien and Kwangtung. It may eventually prove that the southeastern animal is really separable, and that Matschie's name *A. melli* will apply to it in a subspecific sense, but the available specimens from Yunnan and Fukien seem identical. Mell (1922) writes that it occurs in the mountainous region of the northern part of Kwangtung in thin woods with much loose rock at altitudes of 700-850 meters. One that he saw killed a chicken in mid-afternoon on the edge of a village. Shih (1930) has also recorded the animal

from the Yaoshan area of Kwangtung, and Pope found it common in the mountains of Futsing.

Specimens examined:—In addition to a series in the British Museum from Nepal, fifteen, as follows:

Fukien: Futsing, 5; Yenping, 5.
Yunnan: Likiang, 9,000 feet, 1; Milati, near Mengtsz, 1 (B.M.).
Hupeh: Chingfengling, 1 (B.M.).
No definite locality, 2.

179. **Mustela rixosa pygmæa** (J. A. Allen)

PYGMY WEASEL

Putorius (Arctogale) pygmæus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 19, p. 176, 1903.
Mustela nivalis pygmæus Sowerby, Naturalist in Manchuria, vol. 2, p. 70, 1923.
Mustela rix(o)sa pygmæa Mori, Journ. Chosen Nat. Hist. Soc., no. 5, p. 1, 1927.

Type specimen:—An adult female, skin and skull, No. 18322, American Museum of Natural History, from Gichiga, west coast of Okhotsk Sea, Siberia, October 2, 1900. Collected by N. G. Buxton.

Description:—A very small, short-tailed weasel, the length of the tail about equaling that of the hind foot, but not exceeding it.

Color above, from the posterior part of the upper lip back on a line passing below the eye to the base of the ear, to and including the entire tail, a light chocolate brown. This color extends on the upper surface of the fore leg nearly to the wrist and on the outer side of the hind foot to the metatarsals and the sole. The toes of the fore feet, as far back on the dorsal side as the metacarpals or even to the wrist, as well as the soles of the fore feet, the entire under side of the body from the chin to anus, the inner edge of the hind foot, the hind toes on their dorsal surface only, white. Ears very narrowly edged with white. There is no brown rictal spot. Occasionally there may be a few small irregular brown spots in the center of the chest. In winter the entire pelage is white.

There is a slight amount of individual variation in the amount of white on the foot; in some, the white of the inner side of the hind leg is continuous with the white of the side of the ankle and top of the toes; in some the ankle all around is brown, separating the white of the upper side of the toes.

The skull is a minute replica of that of the common European Weasel, with a long, narrow brain case, very short rostrum, and delicate teeth.

Measurements:—The field measurements of two specimens from near Urga, are: total length, male, 157 mm., female, 141; tail, male, 20, female, 17; hind foot, male, 24, female, 20; ear, male, 16, female, 10.

The skull of a subadult female from near Urga, Mongolia, measures: greatest length, 28.0 mm.; basal length, 26.0; palatal length, 10.8; zygomatic

width, 13.0; mastoid width, 13.1; width across molars, 8.6; upper tooth row, 8.2; lower tooth row, 8.6.

Occurrence and Habits:—This very small weasel is at once distinguished from the larger *M. nivalis* of Europe by its color pattern, which lacks the brown rictal spot of *M. nivalis*, and in addition has the toes of fore and hind feet white in summer pelage, with the soles of the hind feet brown.

The capture of three specimens of this weasel at distances from fifteen to forty-five miles north and northeast of Urga extended the recorded range southward and westward into northern Mongolia. One of the specimens is a subadult female with ten mammæ. The three agree in essential details with the description of the type from Gichiga, on the Okhotsk Sea. As a species, this weasel apparently extends into the Japanese archipelago, whence Kuroda has lately named a specimen from Hondo *Mustela rixosa namiyei*, thus recognizing the very close relationship to the North American *M. rixosa*, the type locality of which is Osler, Saskatchewan. No doubt, as with the American forms, this weasel lives largely on mice which it pursues in their burrows and runways.

Sowerby (1923g, vol. 2, p. 71) has recorded the capture of a specimen by him in central Manchuria, at Imienpo, and remarks that the Chinese hunters there regard it as not uncommon in the forests.

As I have elsewhere shown, the Pygmy Weasel extends its range westward quite across Siberia to northern Europe (Norway).

Specimens examined:—Three, from near Urga, Mongolia.

180. **Mustela russelliana** Thomas

DUKE OF BEDFORD'S PYGMY WEASEL

Mustela russelliana Thomas, Abstract Proc. Zool. Soc. London, February 14, 1911, p. 4; Proc. Zool. Soc. London, 1911, p. 168.

Type specimen:—A female, adult, skin and skull, No. 11.2.1.86, British Museum, from Tatsienlu, Szechwan (Hsikang), China. Collected July 1, 1910, by Malcolm P. Anderson.

Description:—Thomas describes the type in summer pelage, as follows. Size extremely small, colors of upper and lower surfaces sharply contrasted. Upper surface uniform dark brown, rather less rich and more drabby than in *M. kathiah*. No darker markings on face or ears. Under surface a beautiful pinkish buff, turning into white anteriorly on the chin, inter-ramia, and lips. A dark rictal spot is present. Line of demarcation very sharply marked, running from upper lip to ankle. Arms brown externally, and buffy on the inner aspect; palms and soles densely hairy. Tail proportionally shorter than

in *M. kathiah*, slender, not tufted, uniformly brown, the tip not noticeably darker.

The skull is distinguished by its very small size from that of allied forms.

Measurements:—The following are from Thomas's account of the species.

	Head and body	Tail	Hind foot	Ear	Sex	Locality
(type)	133	54	22	11	♀	Szechwan
(topotype)	138	54	24	—	♂	Szechwan

Cranial measurements of the type are given as follows: condylobasal length, 29.3 mm.; basal length, 27.2; zygomatic breadth, 15.2; interorbital breadth, 6.2; breadth of brain case, 14; palatal length, 11; front of canine to back of molar, 8; p^4 on outer edge, 2.9 (3.1 in a male).

Occurrence and Habits:—Malcolm P. Anderson, collecting for the British Museum on the Duke of Bedford's Expedition in 1910, captured five specimens of this weasel at Tatsienlu, in central Szechwan (now Hsikang). Nothing further has been published about it, beyond the bare facts of capture contained in Thomas's original account. At first sight one would be inclined to think it closely allied to the Pygmy Weasel, *M. rixosa pygmæa*, but the tail is much longer in proportion, and all the series have the throat white, but the remaining under parts contrastingly pale orange buff; there is also a small rictal spot present, brown as usual. All these traits are quite different from those that characterize the other small species, from which it is no doubt distinct. Possibly it is allied to *Mustela stoliczkana* of Yarkand, an animal of rather similar proportions and appearance, but paler.

The type and three other specimens were all taken at the same locality, Tatsienlu, and within two days, June 30 and July 1, 1910, and since the type, a female, is the only adult among them, it seems evident that Anderson secured part of a single family, for the skulls of the others show that, though perhaps about full-grown, they are still immature, with the more globular, inflated brain cases of youth.

Specimens examined:—Four, including the type, from Tatsienlu, Szechwan (Hsikang), in the British Museum.

181. **Mustela erminea mongolica** Ogney

MONGOLIAN STOAT

Mustela erminea mongolica Ognev, Mém. Sect. Zool., Amis des Sci. Nat., Anthrop. et Ethnogr., Moscow, no. 2, pp. 18, 29, 1928.

Type specimen:—A male, skin and skull, No. 9934, Zoological Museum of the Academy of Sciences, Leningrad, from Dunde Saikhan, Mongolian Altai.

Description:—The color of the summer pelage is described as very pale

yellow with a rusty tint; tail-tip black; lower side of body as in *M. erminea*. The winter pelage is doubtless pure white except for the black tail-tip.

The skull is said to differ from that of the typical race in the "extremely raised and swelled brain capsule and a broad setting of the zygomatic arches."

Measurements:—Not available.

Occurrence and Habits:—It is strange that the ermine does not seem to penetrate far into Mongolia and North China. The only available record of it within the area here considered is that of Ognev, who has named a specimen from the Mongolian Altai, as noted above. As a species, it seems to occur quite across Siberia to Amurland, and Sowerby speaks of it as being well known to the hunters in central Manchuria. The Altai race described by Ognev cannot be very different from the typical race, nor, perhaps, from his *M. e. transbaikalica*, from Bargusin, Siberia.

Specimens examined:—None.

182. **Mustela eversmanni tiarata** Hollister

Mustela tiarata Hollister, Proc. Biol. Soc. Washington, vol. 26, p. 20, 1913.
Mustela larvata Sowerby, in Clark and Sowerby, Through Shên-kan, p. 174, 1912.
Mustela larvata tiarata G. M. Allen, Amer. Mus. Novitates, no. 358, p. 2, 1929.

Type specimen:—An immature male, skin and skull, No. 155160, U. S. National Museum, from Chiuningchow, one hundred and fifty miles east of Lanchow, Kansu, China, 5,500 feet altitude. Collected July 24, 1909, by Arthur de Carle Sowerby.

Description:—A large weasel, with face and forehead dark brown; neck, back, and basal two-thirds of tail light fulvous with short white under fur, the back darkened by long black-tipped hairs. Terminal third of the tail, the throat, chest, and fore legs, also the hind legs and the area between them, as well as a median line connecting the chest-patch with the abdominal patch, black to blackish brown. Sides of the belly buff. Winter pelage paler on body, with forehead and crown as well as sides of face white instead of brown, the nape nearly white with a yellowish wash.

The skull is heavy for a weasel, developing a low sagittal ridge with age. The long upper canines when the jaws are closed extend just ventral to the alveoli of the lower canines. Muzzle short and square; its width at the antorbital foramina equals the width across the postorbital processes. In some specimens the postglenoid portion of the jaw socket is so turned forward that the jaw cannot be disarticulated.

Measurements:—The following table gives the measurements of the type as recorded by Hollister and those of three specimens collected by the American Museum Asiatic Expeditions.

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
155160 USNM	390	150	93	33	♂	Kansu
45604	395	150	63	25	♀	Mongolia
45605	395	170	67	24	♀	Mongolia
45606	400	157	63	27	♀	Mongolia

CRANIAL MEASUREMENTS OF *MUSTELA EVERSMANNI TIARATA*

No.	Condylobasal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Least postorbital width	Upper cheek teeth	Lower cheek teeth	Locality
45604	68.3	64.2	33.4	42.5	37.0	23.0	12.7	21.5	25.7	Mongolia
45605	70.0	66.0	34.0	42.0	36.1	23.4	11.3	20.8	26.0	Mongolia
45606	68.4	64.0	33.2	41.0	35.5	23.5	10.5	21.9	25.4	Mongolia
60102	75.0	69.5	38.0	44.0	42.2	24.7	14.5	23.2	28.0	Mongolia
19893 MCZ	72.3	68.0	36.2	46.5	40.8	25.5	17.5	23.1	27.5	Shansi
60054	75.0	70.4	36.2	50.5	42.4	25.5	15.0	22.5	27.0	?

Nomenclature:—This large weasel is a member of the subgenus *Putorius*, or polecats, a group which includes as its only American representative, the Black-footed Weasel of the western plains, a species rather closely similar to the Asiatic animal. The subgenus is distinguished from the more typical weasels by its stouter form, more bushy tail, different color pattern in which the chest and legs are black, the prominent mastoid processes that project in nearly a right angle at the back of the zygomatic arches, the distinctly triangular outline of the auditory bullæ, and by the slightly less sharply cutting crowns of the premolar teeth.

Described as a distinct species by Hollister, this Masked Polecat of western China is undoubtedly a very close relative of *M. larvata* of southern Tibet, from which it differs mainly in having the blackish facial mask continuous with the dark brown of the forehead, instead of being separated by a distinct white area, and in having the terminal part only of the tail black instead of its entire length. In specimens examined, this last character is variable to the extent that in four skins the black terminal portion is different in each, varying from one-quarter to a third or a half of the tail length. I have regarded it as only subspecifically distinct.

Apparently Hollister's *M. lineiventer* from the Little Altai is a paler race of this same species with the facial mask distinct, while the weasel described by Kastschenko from northwestern Mongolia as *M. michnoi*, is, as Hollister suggested, probably a race of *M. eversmanni*, so far as may be judged from descriptions, and Ognev (1931) has so treated it in his work on "Mammals of Eastern Europe and Northern Asia." A. B. Howell (1929) has recorded *M. lineiventer* from Shansi, while admitting that it is doubtless only subspecifically different from *M. larvata;* but it may be that these lighter-colored examples

were in winter pelage. At all events, the Shansi specimens I have seen appear to be *M. e. tiarata.*

[Since the present account was written, Pocock (Proc. Zool. Soc. London, 1936, pp. 691-723, 2 pls.) has reviewed the Old World polecats, which he regards as constituting a valid genus, *Putorius*. Notwithstanding that in eastern Europe both *P. putorius* and *P. eversmanni* may occur side by side, he includes all the forms as geographic races of the former and places Hollister's *Mustela lineiventer* as a synonym of *P. p. michnoi*. In addition he describes as new, *P. p. admiratus*, a pale race from Chihfeng, northern Hopei.]

Occurrence and Habits:—This large Masked Polecat replaces *M. eversmanni* of western Siberia in Tibet and Mongolia. It probably occurs over most of the Gobi where the country is suitable for marmots, and ranges south into Shansi, central Kansu, and northwestern Szechwan. In addition to the type and two other immature animals from one hundred and fifty miles east of Lanchow, Kansu, Hollister (1929) records specimens in the U. S. National Museum from ten miles west of Sining and one hundred and twenty miles south of Lanchow in the same province. The American Museum Asiatic Expeditions secured others at a place eighty miles south of Urga in the Gobi, and from Paotow and Maitaichao, forty-three miles east of that place, in Shansi. Howell mentions two other skins from Shansi (one from Wutsai, the other from an unknown place) that "match very well the type series of *lineiventer*," but may be identical with this same race. The habits of this ferret are very likely similar to those of our American species, for its seems to frequent marmot colonies, doubtless preying upon these animals or upon ground squirrels. One of the Gobi specimens was taken in a marmot burrow at Tsetsen Wang, and two from the plains southeast of Urga were trapped in similar situations. Dr. Andrews writes of them: "I think they were after the marmots without doubt. I have never seen such an incarnation of fury as these beasts showed when trapped. The musky odor is very strong." The number of young must be fairly large, for one specimen shows distinctly five pairs of mammæ, another six pairs, all close together at the posterior portion of the abdomen.

An interesting specimen is a skin secured in the market at Sungpan, in northwestern Szechwan, near the border of the Tibetan plateau, by the Brooke Dolan Expedition of 1931. It was said to have been locally taken and is now in the collection of the Academy of Natural Sciences at Philadelphia. It was captured in June, and has apparently shed some of the fur over the rump, or still retains some of the paler winter coat, for this region nearly lacks the usual warm buffy wash, while the long black hairs of the lower back seem more abundant than usual. The distal two-thirds of the tail is black. This seems to be the most southern record for the species.

Thomas (1912a) has recorded two male polecats, under the name *Putorius larvatus michnoi* Kastschenko, from the Kunderlun plateau, Achit Nor, northwestern Mongolia, an identification in which Pocock concurs, so far as concerns the subspecies.

Specimens examined:—In all, eight, as follows:

Mongolia: eighty miles southeast of Urga, 3; Tsetsen Wang, 1.

China:

Shansi: Paotow, 1; Maitaichao, forty-three miles east of Paotow, 1; one hundred miles northwest of Taiyuanfu, 1.

Szechwan: Sungpan, 1 (A.N.S.P.).

Genus **Vormela** W. Blasius

TIGER WEASELS

Vormela W. Blasius, Bericht d. Naturf. Gesellsch. in Bemberg, vol. 13, p. 9, 1884 (subgenus). Miller, Mamm. Western Europe, p. 428, 1912 (genus).

Formerly this genus was associated with the polecats (subgenus *Putorius* of *Mustela*), which it resembles in its heavier build, general proportions and in the blackish feet, facial mask, and under side. As Miller has pointed out, however, its curious combination of characters seems to entitle it to generic rank. The peculiar broken and mottled color pattern of the upper surface seems to be a highly specialized one. The claws are long, and very little curved on the fore feet, indicating their use for digging. The skull is heavy and somewhat shorter in proportion than in *Mustela*, with triangular audital bullæ, whose anterior internal points are in contact with the hamular processes of the pterygoids. The tooth formula is the same as in *Mustela*, namely: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{1}{2}$, but the teeth are stouter, the canines of the upper jaw unusually long, the inner lobe of the upper carnassial larger, the upper molar set at an angle to the tooth row with its outer end anterior to the inner. In the lower jaw the specialization of the carnassial has not proceeded so far as in *Mustela*, for there is still a distinct metaconid present as a small point on the inner side of the summit of the main cusp, a conid that has been eliminated in *Mustela* to enhance the cutting action of the tooth.

The Tiger Weasels seem to be dwellers in steppe country, and occur from Roumania and eastern Hungary eastward across the Russian steppes into the Gobi, where the Russian *V. peregusna* is represented by a paler subspecies. The type species is *Mustela sarmatica* = *Vormela peregusna* (Gueldenstädt).

183. **Vormela peregusna negans** Miller

EASTERN TIGER WEASEL

Vormela negans Miller, Proc. U. S. Nat. Mus., vol. 38, p. 385, pl. 17, 1910.

Type specimen:—A skin without skull, adult male, No. 155001, U. S. National Museum, from the Ordos Desert, about one hundred miles north of Yulinfu, Shensi, China.

Description:—This desert race differs from the European form in the still greater reduction of the brown on the dorsal area, leaving a larger amount of yellowish background, a peculiarity of pattern recalling that of a coach dog or a domestic rabbit of the "English" type. A very dark brown facial mask extends from the upper edge of the rhinarium to the upper eyelid, and thence as a narrow line downward and backward to join the black of the throat; a similar but darker-brown patch of triangular shape covers the forehead between the ears and extends back from the outer corner of the ear to join the black of the throat. There is thus a white ring which includes the chin and both lips separated by the first dark patch from a second white ring passing back of the eyes and below the ears but not quite complete ventrally. Nape and shoulders nearly clear buffy white, the rest of the back to root of tail mostly buffy, mottled with dark brown. Upper part of fore limbs dark yellowish brown, passing into blackish on the forearms and feet. Throat, chest, belly, hind legs and feet, and base of tail ventrally, black. Tail whitish in general appearance for the basal two-thirds, the long hairs having buffy bases, then a broad ring of brown and the terminal third whitish. The tip of the tail is blackish brown all around.

The skull of the type was missing, but one from Mongolia secured by the Central Asiatic Expeditions is not very different from a skull from Russia, with upper canine longer than depth of rostrum above its root and the inner lobe of the carnassial as wide as the outer.

Measurements:—The type skin as made up, measured approximately, head and body, 340 mm.; tail, 210.

A skull of this weasel from P'angkiang, Mongolia, though broken, shows the following dimensions: length of upper canine, 10.5 mm.; depth of rostrum above it, 9.6; upper tooth row, canine to molar, 18; orbit to gnathion, 15; gnathion to posterior rim of glenoid fossa, 35.6; width outside fourth premolar, 21; width of rostrum, 15.5; lower tooth row, 23.5. The skeleton has eleven pairs of ribs.

Occurrence and Habits:—The two skins that served as the basis of Miller's description were obtained by natives in the Ordos Desert, about one hundred miles north of Yulinfu, Shensi. The only other record seems to be the skeleton secured by the Central Asiatic Expeditions in April, 1922, at P'angkiang, Mongolia. Sowerby, who brought back the first two skins, says that the species seems to be not at all common and frequents spots where there are trees, in which it climbs freely. Its native name "ma-nai-hou" he suggests may indicate this habit, since "hou" signifies monkey.

Specimens examined:—One, a skeleton, from P'angkiang, Mongolia.

Genus **Helictis** Gray

FERRET-BADGERS

Helictis Gray, Proc. Zool. Soc. London, 1831, pt. 1, p. 94.

The Ferret-badgers are somewhat more heavily built than the weasels, with less slender bodies, strong fore claws, greatly developed cartilaginous snout, and are characteristically colored a brownish gray above, more or less hoary, with white facial markings on forehead, cheeks, and ears, and often with a varying amount of white in the midline of the nape and foreshoulders. It is an interesting fact that the several species of eastern Asia, though externally very similar, are very different in their cranial characters. Thomas (1922a) has lately reviewed the group and recognizes three genera for the ferret-badgers of China, India, and North Borneo, but in view of the quantitative nature of the characters described, it may be better to regard these divisions as of subgeneric value only, for the species are obviously closely allied. For the Indian *Helictis personata*, Thomas erects the genus *Melogale*, distinguished by its heavy teeth, the lower second premolar disproportionately larger than the first, and the upper carnassial with its external border convex instead of nearly straight. There is a smaller race of this species that Thomas has described from Tongking, *Helictis* (*Melogale*) *personata tonquinia*, that very likely will be found to occur across the border in Yunnan as so many other tropical species do, but hitherto no specimens have been taken within Chinese territory. Thomas has pointed out a further distinction between the Indian and Siamese subgenus in the character of the baculum or penis bone, which in *Melogale* is bifid terminally, with the prongs thickened, one of them forming a curved crest, whereas in the Chinese *H. moschata* the tip is trifid with the slightly thickened terminal prongs set in a triangle. This difference, however, is less sharp than might appear, for in a baculum of *H. p. tonquinia* in the Museum of Comparative Zoölogy, there is a third prong present, though small. It is obviously the ventral prong of the three in typical *Helictis*. An additional peculiarity of *Melogale* as contrasted with *Helictis* proper is that the prominent temporal ridges are heavier and more nearly medial, curving strongly inward from the supraorbital processes, so that their point of closest approximation is about the diameter of the orbit behind these processes, and from there back the ridges diverge slightly. In *Helictis* of the *moschata* group, the ridges are less heavy, much wider apart, and either parallel or slightly bowed outward over the brain case, occasionally converging at their posterior ends. The close similarity in size and general appearance of these two species makes it seem likely that their geographic ranges are mutually exclusive or nearly so. Anderson (1879) long ago recorded *Helictis moschata* from western Yunnan, but it is possible that the specimen is referable to the species that

Thomas has since discriminated as *H. millsi*, type locality, Assam. There are four inguinal mammæ.

In its tooth characters, *Helictis* is peculiar in the development of the large fourth upper premolar, whose internal lobe is very wide with a strong erect cusp, standing nearly in the middle of a wide platform formed by the rest of the lobe. The upper molar is nearly a parallelogram in outline, with the outer border about equaling the inner, and the entire tooth is set at a slight angle, with its outer end a little forward of the inner. The lower carnassial (m_1) has the anterior trigon well developed, the three cusps (protoconid, paraconid, and metaconid) of about equal size, while the heel consists of a somewhat basin-like portion with a sharp-edged rim not showing definite cusps. The tooth formula is: $i.\frac{3}{3}$ $c.\frac{1}{1}$ $pm.\frac{4}{4}$ $m.\frac{1}{2} = 38$. The last lower molar is a very small tooth, round in cross-section, with an outer and an inner cusp, distinct but small. The type species is *H. moschata*.

Two species of Ferret-badgers occur in southeastern China, which though externally rather similar in general appearance may be distinguished by the characters given in the key following. The group is chiefly a subtropical and tropical one, extending into southeastern China to the Yangtze valley.

KEY TO THE CHINESE SPECIES OF *Helictis*

A. Size larger, hind foot 60-65 mm., a brown rictal spot present.
   a. Greatest length of skull averaging 77 mm. in males, under parts usually more buffy, bases of dorsal hairs paler..... *H. moschata moschata*
   b. Greatest length of skull averaging 80 mm. in males, under parts usually whiter, bases of dorsal hairs hardly paler..... *H. m. ferreo-grisea*

B. Size smaller, hind foot 45 mm., no rictal spot present..... *H. taxilla sorella*

184. **Helictis moschata moschata** Gray

COMMON FERRET-BADGER

Helictis moschata Gray, Proc. Zool. Soc. London, 1831, pt. 1, p. 94.

Type specimen:—A skin and skull, No. 207a, in the British Museum, sent by John Reeves, Esq., from Canton, Kwangtung, China, about 1830.

Description:—General color of the body, and outer sides of the limbs and the feet, chocolate brown, the bases of the hairs paler on the dorsal surface of the body. On the head there is a squarish white spot occupying about one-half the space between the eyes in the median line; the sides of the face below the eye, as well as an area in front of the ear, are white, and both these white areas are continuous with the yellowish white of the lips, chin, throat, and middle of the belly and inside of the legs. A large, elongate rictal spot is present below the white of the cheeks and behind the angle of the mouth. The hair of the throat is white to the roots, but elsewhere ventrally, the white hairs are pale chocolate basally. On the occiput there is a second prominently

contrasted white squarish spot, which may be continued more or less interruptedly backward as a median white line to the shoulders. The tail is like the back, dull chocolate all around, well haired, the longer hairs with pale tips, which at the proximal portion are inconspicuous but terminally are very much more extensive, producing a whitish tip to the tail.

The pattern varies more or less in the extent of the white markings about the head. Swinhoe (1870a, p. 228) mentions a skin from Hainan in which the pale spot between the eyes was lacking.

The chief characters of the skull have already been mentioned. The prominent longitudinal temporal ridges are very striking.

Measurements:—No fresh measurements are available, but in general size the typical race hardly differs from that of the provinces to the north (see under *H. m. ferreo-grisea*).

CRANIAL MEASUREMENTS OF *HELICTIS MOSCHATA MOSCHATA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Orbit to end of rostrum	Upper cheek teeth	Lower cheek teeth	Sex	Locality
59978	78.0	69.1	35.0	43.0	35.0	21.5	28.0	22.6	27.7	♂	Hainan
60057	77.0	66.0	32.3	39.7	33.9	21.0	25.5	22.3	27.0	♂	Hainan
60059	74.3	66.8	33.0	47.0	34.2	21.5	25.4	22.0	25.8	♂	Hainan
60087	77.5	70.1	35.0	44.0	35.2	21.9	28.0	23.5	28.5	♂	Hainan
Average	76.7	68.0	33.8	43.4	34.5	21.5	26.7	22.6	27.2	♂	
59977	74.0	64.5	32.2	43.7	32.4	20.3	25.0	22.0	27.0	♀	Hainan
59979	73.4	63.5	32.0	41.5	35.0	20.8	25.0	20.5	25.0	♀	Hainan
59980	75.0	66.7	34.8	43.0	34.4	19.7	27.0	22.8	27.0	♀	Hainan
59928	81.5	71.6	39.3	45.0	37.2	21.3	29.0	25.3	29.0	♀	Hainan
60031	76.2	67.0	33.0	43.0	35.0	20.9	26.5	22.3	26.3	♀	Hainan
60032	77.0	66.8	32.6	46.0	36.1	21.5	26.1	22.1	26.6	♀	Hainan
60033	73.7	65.0	32.0	46.1	35.4	21.0	25.8	21.5	26.0	♀	Hainan
60034	73.0	63.5	31.7	40.1	33.2	20.3	24.8	21.4	25.8	♀	Hainan
60035	71.0	62.7	30.9	44.0	35.5	21.0	24.0	21.3	24.8	♀	Hainan
60058	73.8	65.5	30.9	39.5	34.0	20.2	25.0	23.0	26.5	♀	Hainan
Average	74.8	65.6	32.9	43.1	34.8	20.7	25.8	22.4	26.6	♀	

From these figures it seems that the males, although a very little larger in some of their measurements, do not exceed females in any striking way.

Occurrence and Habits:—The Ferret-badgers are well named, their long cartilaginous snout and thickset appearance giving them a certain resemblance to a badger, while their long tails, slightly less than body length, more recall a ferret. This is apparently not an uncommon species in the subtropical parts of extreme southern China, grading into the following race which occurs over most of South China. The original specimen was sent to the British Museum from Canton by John Reeves, Esq., but Mell (1922, p. 17) says that

so far as he knows it has not since been taken there, so it is quite likely that Reeves purchased the animal from some one who brought it in to the market from outside. Nevertheless Mell says that in general it occurs everywhere in Kwangtung, but is commoner in the more northern part. Swinhoe has also recorded it from Amoy and even Shanghai, although on geographical grounds the animal from the latter locality is perhaps the following race, *H. m. ferreo-grisea*. Mr. Clifford H. Pope secured a fine series while collecting for the American Museum on the island of Hainan, and these I have followed the late J. A. Allen (1906) in regarding as typical *H. m. moschata*. Probably the animal recorded by Shih (1930, p. 5) from the Yao Shan area, Kwangsi, as "*Nasua narica*" is really the species under consideration, for he remarks of it that it is "somewhat divergent from that of Fukien." Probably referable to the typical form also, is a single hunter's skin secured by Dr. Roy C. Andrews at Likiang, Yunnan; it is without measurements or skull, and its tail seems longer than in the other specimens seen.

Little seems to have been published on the habits in China. Mell (1922) says that on June 6 a female with two sucklings, one-third grown, was taken in a hole among rocks at the foot of a tree at Wutsung, and a second female, also with two young, in late May at Fungwahn, Kwangtung. One specimen taken had bones in the stomach. Pope notes that although these little animals seem somewhat stupid in life, they are very tenacious of existence and difficult to kill by choking, the usual Chinese method.

Specimens examined:—Twenty, as follows:
Hainan: Nodoa, 14; Namfong, 4.
Yunnan: 1 (hunter's skin bought at Likiang).
Kwangtung: 1 (B.M.), the type.

185. **Helictis moschata ferreo-grisea** Hilzheimer

Helictis ferreo-griseus Hilzheimer, Zool. Anzeiger, vol. 29, p. 298, 1905; Abh. u. Ber. Mus. f. Natur- u. Heimatk., Magdeburg, vol. 1, p. 176, 1906.
Helictis moschata Swinhoe, Proc. Zool. Soc. London, 1870, p. 623 (in part).
Helictis moschata ferreo-grisea G. M. Allen, Amer. Mus. Novitates, no. 358, p. 7, 1929.
?*Mustela lavarta* (sic) Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 9, p. 2, 1930.

Type specimen:—The type is a male skin without skull in the Magdeburg Museum, Germany, described without mention of a definite locality, but in a later paper the author (Hilzheimer, 1906) states that it was from near Hankow, Hupeh, China. Probably it was a trade skin purchased in the market.

Description:—This is a barely distinguishable race, closely similar to typical *H. moschata*, but averaging slightly larger, the skull a little larger, the winter pelage longer and clearer white in the white areas than in the more southern race. In general the tone of the pelage is grayer, especially in winter, but presents the same full chocolate-brown coloration with the white facial

and occipital marks, the latter often continued as a stripe of variable length to the shoulders. Usually the white of the under parts is without the buffy tint of the more southern animals, though this is not invariable, and the bases of the hairs above are paler.

Males average a very little larger than females in cranial dimensions.

Measurements:—The following measurements were taken in the field by the collector:

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
43168	370	150	65	—	♂	Fukien
58272	385	190	68	35	♂	Szechwan
43167	340	140	60	—	♀	Fukien
58270	375	150	65	35	♀	Szechwan
58272	385	190	61	37	♀	Szechwan

CRANIAL MEASUREMENTS OF *HELICTIS MOSCHATA FERREO-GRISEA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Orbit to end of rostrum	Upper cheek teeth	Lower cheek teeth	Sex	Locality
43168	79.5	70.7	36.0	48.3	36.0	21.0	28.5	24.2	29.0	♂	Fukien
44710	80.2	70.0	36.7	49.0	37.0	21.0	28.5	23.4	27.0	♂	Fukien
85029	81.0	71.5	38.0	46.8	38.0	21.5	30.2	25.0	29.0	♂	Fukien
45336	81.2	71.8	37.1	49.7	38.2	21.8	29.0	25.2	28.8	♂	Chekiang
85026	81.0	73.2	37.8	47.0	36.2	22.1	30.0	25.7	29.0	♂	Fukien
58272	83.2	73.2	37.0	48.0	38.0	21.2	29.2	25.0	28.0	♂	Szechwan
58276	81.8	70.7	36.0	44.9	36.0	22.0	27.6	24.0	28.0	?	Szechwan
20019 MCZ	80.4	71.0	37.4	45.0	38.7	22.3	29.2	24.0	28.8	?	Kiangsu
44708	75.2	65.0	34.5	42.0	33.8	20.1	27.1	22.7	26.5	♀	Fukien
44709	78.4	67.9	36.0	42.7	35.3	21.3	28.9	23.5	28.0	♀	Fukien
60191	79.3	68.9	34.5	45.0	36.3	21.9	28.0	23.4	28.0	♀	Fukien
85027	79.2	68.9	36.0	42.8	35.4	21.9	27.8	23.8	28.0	♀	Fukien
85028	78.0	67.2	35.1	42.2	33.6	20.1	27.3	23.8	27.1	♀	Fukien
57033	81.6	71.6	37.0	45.7	37.9	21.0	28.5	23.8	27.8	♀	Hunan
58271	77.0	68.0	34.8	46.0	36.2	20.3	28.0	24.0	27.8	♀	Szechwan

Occurrence and Habits:—The Ferret-badger of central China covers a wide area and seems fairly common and well distributed. The American Museum Asiatic Expeditions secured specimens at several localities in Fukien, namely: Futsing, Yenping in the mountains, and at Chunganhsien; as well as at Tunglu in Chekiang, near the mouth of the Yangtze; Yochow in Hunan, and several from Wanhsien on the eastern border of the Szechwan highlands. Apparently it is not found in the high country of western China, although it follows the Yangtze into the east-central part of Szechwan, whence the U. S. National Museum has specimens taken at Suifu and Kiating (A. B. Howell, 1929). Probably, too, the specimen from Shanghai and the one from Yochow, in the same institution, recorded by Howell, should represent the more northern

race. The Museum of Comparative Zoölogy has a specimen secured by Dr. F. R. Wulsin at Ningpo, Chekiang. It would seem that the species does not range much north of the Yangtze basin in eastern China, so that probably the skin without skull in the American Museum, labeled as from Maitaichao, Shansi, was probably not actually taken there, but brought in from the south.

Very little information as to the habits of this animal seems to be published. The number of mammæ, four, is in keeping with the apparently small number of young, two in two cases mentioned under the typical race, and in contrast to the large litters produced by some of the weasels.

Specimens examined:—Twenty-six.
Fukien: Futsing, 4; Yenping, 5; Chunganhsien, 4.
Chekiang: Ningpo, 1 (M.C.Z.); Tunglu, 2.
Hunan: Yochow, 3.
Szechwan: Wanhsien, 5.
Shansi: Maitaichao, 1 (probably not native there).
No definite locality, 1.

186. **Helictis taxilla sorella** G. M. Allen

LESSER FERRET-BADGER

Helictis taxilla sorella G. M. Allen, Amer. Mus. Novitates, no. 358, p. 8, 1929.

Type specimen:—An adult male, skin and skull, No. 85030, American Museum of Natural History, from Futsing, Fukien, China. Collected February 21, 1926, by Clifford H. Pope, Central Asiatic Expeditions.

Description:—In general resembling *H. moschata* in external appearance, but much smaller, the ears slightly larger in proportion, the claws of the fore feet somewhat more curved, the metatarsal pads shorter. An obvious difference in color pattern lies in the absence of the dark rictal spot.

Color, pale chocolate brown above, becoming hoary on the sides; tail narrow and long-haired, the chocolate hairs predominating on the basal half, the white-tipped hairs on the distal half. The hair of the back is whitish at base. The white head markings, though recalling in pattern those of *H. moschata*, differ in that the white interorbital spot tends to be more linear than squarish (in one specimen it extends from nose-pad to crown as a broad line); the cheeks behind the eye are grizzled chocolate gray and whitish instead of having a dark spot extending backward from the posterior corner of the eye, with an area of clear white above and below; and finally the brown spot behind the corner of the mouth in *H. moschata* is lacking in this species. A cluster of small tactile hairs arises from this spot in the latter species, but in *H. t. sorella* these vibrissæ are much smaller, in correlation perhaps with the loss of the pigmented spot, a characteristic mark of many weasels. Ventral surface of

the body, including the fore legs to the wrists and the hind legs to the ankles, dull white. Inside of the ears and their outer rims whitish.

The skull is more slender than that of *H. moschata*, especially in the rostral portion, and has a lower and less inflated brain case. The temporal ridges are wide apart and nearly parallel. The entire skull is smaller as well, but the tooth rows are very nearly as long as in *H. moschata*, and slightly longer than in *H. taxilla taxilla*, requiring thus a long and slender rostral portion for their accommodation. The distance between the upper molars equals the width of the postpalatal tube, whereas in the larger *H. moschata* it exceeds that width.

Measurements:—The collector's measurements of the type and a topotype are respectively: head and body, 330, 320 mm.; tail, 140, 150; hind foot, 40, 40. In the dried skin, however, the foot without claw measures in each, 45 mm.

CRANIAL MEASUREMENTS OF *HELICTIS TAXILLA SORELLA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Orbit to tip of rostrum	Upper cheek teeth	Lower cheek teeth	Sex	Locality
85030	71.0	63.8	33.6	37.0	30.2	18.2	24.8	23.0	27.0	♂	Fukien
85031	69.5	60.4	33.0	37.8	31.5	18.0	23.5	22.4	25.5	♀	Fukien
38329	72.7	65.0	35.5	39.3	31.1	18.8	25.6	23.0	27.2	♀	Fukien

There does not seem to be any obvious difference in size between the two sexes so far as these few specimens show. For comparison, the type of *Helictis taxilla* in the British Museum has a skull length of 77.7 mm., basal length, 74 (in a second, 69); mastoid width, 34; orbit to rostrum, 21.5.

Occurrence and Habits:—This is apparently a smaller race of the Tongkingese *H. taxilla*, distinguishable by its smaller skull in combination with the large size of the teeth, which are even slightly larger than in the latter, to judge from Thomas's measurements.

The species bears so close an external resemblance to *H. moschata* that it might on casual inspection easily be confused with that animal, but its smaller size, gray cheeks, the lack of a rictal spot, the much shorter metatarsal pads, and the weaker and slightly curved fore claws are obvious points of difference. In the case of two species so similar in general aspect, living in the same region, one suspects a difference in habits, and it may be that the last two points indicate modifications for tree-climbing instead of a more terrestrial existence.

Thomas was the first to discover this smaller type of ferret-badger, among specimens sent from Tongking to the British Museum. The capture of specimens in northern Fukien, China, extends the known distribution of the species a thousand miles to the northeast. Nothing was observed, however, of a distinctive nature about its habits. No doubt further investigations will disclose the presence of the species in other places in southeastern China, and prove its

intergradation with the typical race of Tongking. The four specimens in the American Museum are all from northern Fukien, in an area where there is still a certain amount of wild and partially forested country.

Specimens examined:—Four, as follows:

Fukien: northwestern part, 2; Futsing, 2.

Genus **Meles** Brisson

BADGER

Meles Brisson, Regn. Anim. in Classis IX distrib., Quadr., ed. 2, p. 13, 1762; or Storr, Prodromus Meth. Mamm., p. 34, 1780.

Badgers are large, stoutly built members of the Mustelidæ, with short, well-muscled fore limbs, and long, nearly straight claws for digging. The nose has a strong cartilaginous termination and an external nose-pad of good size as a further aid in burrowing. Both this and the next genus, *Arctonyx*, have relatively narrow and elongate skulls as compared with the broader and nearly triangular skull of the American Badger. Other points of difference have led Pocock (1921b) to regard the two Old World genera as more closely allied to each other than to the American Badger, so that he places them in the subfamily Melinæ, while the American Badger (*Taxidea*) is made the representative of a separate subfamily, Taxideinæ. In *Meles*, as in *Arctonyx*, the last upper premolar, pm^4, has a broad internal ledge, giving the tooth a nearly triangular outline in crown view. This ledge in *Meles* has a low but prominent cusp on the middle of the postero-internal border, and two still smaller cusps at the inner apex of the triangle, obvious in unworn teeth. The upper molar is a large broad tooth, in crown view nearly rectangular in outline, with the outer, posterior corner rounded off, so that the external edge is shorter than the internal. The two outer cusps, paracone and metacone, are prominent, while a third smaller cone stands behind the latter, forming the postero-external corner of the tooth. A low ridge, apparently constituted by the protoconule, protocone, and closely approximated hypocone, runs lengthwise in the center of the tooth, while the internal border is extended medially as a low shelf separated by a deep groove from the central ridge. In the lower jaw, the first molar is much elongated, its paraconid and protoconid shearing against the upper carnassial, while its posterior heel is long and basin-shaped, its rim formed by two external and three inner cusps. The second lower molar is much smaller and nearly circular in crown view. The palate is continued back from the level of the last molars as a narrow and nearly parallel-sided tube, not quite reaching the level of the jaw articulation, beyond which the hamular processes extend as thin vertical rods nearly as far back as the prominent and inflated audital bullæ, all quite in contrast to the conditions in

Arctonyx. The dental formula is usually the same in both genera, namely: $i.\frac{3}{3}$ $c.\frac{1}{1}$ $pm.\frac{3}{3}$ $m.\frac{1}{2} = 34$.

Only one species of *Meles* is represented in eastern Asia, and it extends over most of eastern China. Its relationship to the European Badger seems only subspecific, nor does the material at hand indicate any tangible differences between the animals of North and South China.

187. **Meles meles leptorynchus** Milne-Edwards

CHINESE BADGER

Meles leptorynchus Milne-Edwards, Ann. des Sci. Nat., Zool., ser. 5, vol. 8, p. 374, 1867.
Meles leptorhynchus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 190, pl. 25; pl. 26, figs. 3, 4; pl. 27, figs. 3, 4; pl. 28, figs. 3, 4, 1868-74.
Meles chinensis Gray, Proc. Zool. Soc. London, 1868, p. 207. Amoy.
Meles leucurus Trouessart, Cat. Mamm. Viv. Foss., p. 188, 1904. J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 430, 1909.
Meles hanensis Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 138, 1908.
Meles siningensis Matschie, *loc. cit.*
Meles tsingtauensis Matschie, *ibid.*, p. 142.
Meles meles leptorynchus G. M. Allen, Amer. Mus. Novitates, no. 358, p. 9, 1929.
Meles meles leucurus Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, p. 262, 1932.

Type specimens:—No single specimen is mentioned by Milne-Edwards as the type of this badger, but he states that the Paris Museum received several specimens from "les environs de Pékin," Hopei, China, sent by M. Fontanier. The specimens are, therefore, cotypes, and presumably are still in the collection of the Muséum d'Histoire Naturelle.

Description:—This badger is at once distinguished from *Arctonyx* by its black throat (white in the latter), and its short stumpy tail of the same mixed blackish-brown and white as the back, whereas in *Arctonyx* the tail is longer and usually for the greater part white. The mid-dorsal area from between the ears to the tail-tip is clothed with long, rather coarse hairs, having their basal three-fourths a grayish white, succeeded by a blackish-brown ring and a short white tip. At the sides of the body the blackish rings tend to become absent, producing a pallid tint. On the head there is a whitish stripe from the angle of the mouth on each side to and beyond the base of the ear, and a median whitish stripe from the tip of the muzzle running back to the level of the eyes or even farther, to the occiput. These two stripes separate off a blackish-brown stripe from the muzzle that runs back along the side of the face, to include the eye, merging at the back of the head with the mixed color of the dorsal side. The lower side of the body from the chin to the root of the tail, as well as the feet, forearms, and lower legs, are uniform blackish-brown.

Compared with the European Badger, the Chinese race has the white facial stripes shorter, and the pale tips of the dorsal hairs are less extensive,

and are tinged with buffy instead of pure white. The median white stripe on the muzzle is usually clear and broad to or slightly past the level of the eyes, beyond which it becomes smoky brown or even heavily brown, and in one of eleven skins is darkened quite to the nose-pad; these markings are thus slightly more obscured in the eastern animal.

The skull differs from that of the typical European race in being slightly smaller, with the sagittal ridge not so well developed. Moreover, in the skulls of the Chinese Badger examined, there is no indication that the first small premolar, pm$\frac{1}{1}$, is ever present as it often is in the European animal, for in all those seen there is not even a small space where it might stand in the tooth row. The audital bullæ are slightly more inflated also. In old skulls, even the nasal bones fuse intimately with the surrounding bones, so that the boundaries cannot be made out.

Measurements:—A male, not fully mature, from the Eastern Tombs, Hopei, was measured by the collector as follows: head and body, 450 mm.; tail, 130; hind foot, 95; ear, 40.

CRANIAL MEASUREMENTS OF *MELES MELES LEPTORYNCHUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
19953 MCZ	117.2	104.0	63.0	68.1	61.0	32.8	38.0	41.5	Ad.♂	Shansi
19954 MCZ	114.5	101.0	63.0	63.0	56.4	37.0	36.0	43.5	♂	Shansi
45334	122+	112.5	66.5	——	58.0	40.0	40.0	46.5	?	Chekiang
1505d BM	125.8	110.3	66.3	——	63.5	37.5	38.0	46.2	♂	Fukien
57031	119.0	106.0	63.6	65.7	57.2	35.8	35.6	42.5	♀	Hunan
57114	113.5	101.6	62.5	59.5	52.8	36.5	36.3	43.5	♀	Hunan
57117	124.5	108.5	66.0	68.0	58.5	37.6	37.0	44.7	♀	Hunan
84356	116.0	104.0	61.0	60.2	54.2	35.9	35.5	43.1	♀	Szechwan
85048	125.0	110.5	66.0	67.8	57.0	37.0	39.0	46.9	♀	Fukien
19952 MCZ	116.8	103.3	61.5	59.6	55.0	36.0	35.8	43.2	♀	Shansi
19955 MCZ	116.0	103.8	62.5	67.0	57.0	39.0	37.3	44.5	♀	Shansi
1505a BM	110.2	101.5	61.3	61.8	56.3	36.5	35.3	——	♀	Fukien
1505c BM	120.2	102.5	63.7	64.2	58.0	——	35.2	42.5	♀	Fukien
9.1.1.17 BM	123.0	113.0	68.9	70.5	58.4	38.2	40.0	47.7	♀	Shensi

From these measurements it is not evident that males are larger than female specimens.

Nomenclature:—Milne-Edwards, in naming this badger, spelled the specific designation *leptorynchus*, but in later publications it is usually given the form *leptorhynchus*. He compared it with the European Badger and regarded the two as very closely related, so that the chief differences lay in small skull characters. Shortly afterward, in 1868, J. E. Gray gave the name *Meles chinensis* to a specimen sent by Consul Swinhoe to the British Museum from

Amoy. This, however, Milne-Edwards regarded as a synonym of *M. leptorynchus*, apparently with reason, for he, too, received skulls from the same source. Matschie, in 1908, named as new species three separate skins purchased in fur markets of eastern China by the Filchner Expedition. The first of these, *Meles hanensis*, was said to have come from the mountains near Hinganfu, southeastern Shensi, while the second, *Meles siningensis*, was from Siningfu, in Kansu. They were said to be much alike, except that one had black-ringed hair on the back, the other black-brown; the tip of the tail was white in one, dirty white in the other, without the dark basal rings to the hairs. These are, however, evidently merely matters of individual variation. The same may also be said of Matschie's *Meles tsingtauensis*, based on a skin from near Tsingtao, Shantung, sent by von Stegmann and Stein to the Berlin Museum (type, No. A.33.06). Osgood (1932) suggests that the name *M. m. leucurus* may have to replace *M. m. leptorynchus*.

Occurrence and Habits:—This representative of the European Badger seems to be distributed over most of eastern China from Hopei westward across Shansi and northern Shensi to eastern Kansu, and thence southward, avoiding the higher, mountainous parts of western China, to extreme eastern Szechwan and on the east coast as far south as the latitude of Hongkong. Outside the Chinese area, it extends northeastward into Amurland. Over this vast territory its characters seem to be remarkably uniform, and I have found no satisfactory way to separate the North China animals from those of South China. Milne-Edwards long ago mentioned that skins from Amoy had shorter hair than those from Peiping, but it is not certain how far this character holds true. The Amur Badger has been given the name *M. amurensis* by Schrenck, who regarded it as a subspecies of the European animal. In addition to the original series of *M. leptorynchus* sent to the Paris Museum from near Peiping, the American Museum Asiatic Expeditions secured a specimen from the Eastern Tombs, and A. B. Howell (1929) records specimens in the U. S. National Museum from Tientsin and Tabool, the latter locality near the southern edge of the Mongolian plateau, northwestern Hopei. From Shansi to the westward, the American Museum has a specimen from Pingtinghsien, and others in the Museum of Comparative Zoölogy were secured by Dr. F. R. Wulsin from Pashuiko, Taiyuanfu, and Yirgo in the northwestern part of the same province. Thomas (1909) mentions one from Yulinfu, Shensi; another from the Tao River, Kansu, recorded by A. B. Howell (1929), is from one of the most western localities. Farther south, the Central Asiatic Expeditions secured a specimen at Wanhsien, eastern Szechwan, which marks nearly the limit of distribution in west-central China on the edge of the highlands, while Osgood's (1932) record from near Tatsienlu, Szechwan, carries it farther to the west. Eastward, again, several specimens in the American Museum were secured at Yochow,

Hunan, and one at Tunglu, Chekiang, near the mouth of the Yangtze, whence it ranges south into Fukien, where it has been taken at Foochow and Yenping (A.M.N.H.), and in the vicinity of Amoy (Swinhoe, 1870c, p. 622). Still farther south, Mell (1922) writes that it occurs on the island of Hongkong, Kwangtung, and on the neighboring mainland, but is probably absent inland from about Canton, for in fourteen years' residence there he had seen but one brought into the Canton Market. He mentions also a specimen preserved in the City Hall Museum at Hongkong.

According to Swinhoe, this is a common species in the Tinggan district near Amoy, in hilly country. In winter it lies torpid, but in summer visits the sweet-potato fields, uprooting and eating the sweet potatoes, whence the Chinese name of "Sweet-potato Pig." In North China, Sowerby (1914, p. 48) notes that, although the hair is too stiff and the hide too thick to make the badger a desirable fur animal, its skin is nevertheless in demand among the Chinese on account of its damp-resisting qualities. Made into rugs, they use it to spread on their brick kangs or in carts. "The Manchurian hunters all wear nicely dressed badger skins hanging from their belts at the back, in which position they are always ready to form a dry seat."

An interesting anomaly is shown by a skull from Foochow (No. 85048, A.M.N.H.), in which the second upper premolar is missing on both sides, and in the lower jaw, the corresponding tooth of the left side. Among several skulls in the British Museum, one lacks the first lower premolar on the right side, and another lacks that of the left side. In a third, the first upper premolar is absent on the left side only.

Specimens examined:—Twenty-four, as follows:
Hopei: Eastern Tombs, 1.
Shantung: Tsinan, 1 (B.M.).
Chekiang: Tunglu, 1.
Kiangsu: Nanking, 1 (Univ. Mich.).
Shansi: Pashuiko, 2; Taiyuanfu, 1; Pingtinghsien, 1; Yirgo, 1 (all M.C.Z.).
Shensi: Yulinfu, 1 (B.M.).
Hunan: Yochow, 3.
Fukien: Foochow, 2; Yenping, 2; Amoy, 4 (B.M.).
Szechwan: Wanhsien, 1; Sungpan, 1 (A.N.S.P.).
No exact locality, 1.

Genus **Arctonyx** F. Cuvier

Arctonyx F. Cuvier, in Geoffroy and Cuvier, Hist. Nat. des Mammifères, vol. 3, pt. 51, pl. and 2 pp. text, 1825.

The badgers of this genus are readily distinguished from *Meles* by their white instead of black throat, the somewhat longer and more tapering tail, and the pale instead of dark-colored claws. There is an area of naked skin between

the nose-pad and the upper lip which in *Meles* is thickly haired. The skull differs in the two genera in many important particulars. Although rather long and narrow in both, the interorbital region in *Meles* is high and swollen but depressed and sloping strongly downward in *Arctonyx*. In the latter the forehead is wider, the antorbital foramen much larger, the rostrum more elongated. In ventral aspect the audital bullæ are very much less inflated, not reaching the level of the hamular processes of the pterygoids, which in further contrast are broad and flattened, diverging posteriorly instead of being parallel. The bony palate is prolonged backward to the level of the posterior rim of the glenoid cavity of the jaw, somewhat concave as viewed from the ventral side, but inflated laterally. The upper incisors are arranged in a horseshoe shape, the outer pair with compressed and lengthened crowns, twice the length of the crowns of the second pair. The upper canines are long and laterally compressed, with a slightly beaded posterior edge. The two anterior upper premolars have each two roots and are separated by a short space. The posteriormost premolar is distinctly triangular as seen from above, its postero-internal edge extended to form a narrow ridge-like cusp. The upper molar is nearly diamond-shaped, with a rounded posterior lobe. The paracone and metacone are low, and stand at the antero-external edge, while two other lower cusps are in a somewhat similar position on the postero-external rim. A low ridge, the elements of which seem similar to those seen in the upper molar of *Meles*, passes lengthwise on the inner side of the tooth, but its internal bounding ledge is narrower. In the lower jaw the first molar is long and narrow, with the paraconid and protoconid nearly in line and shearing against the outer cusps of the upper premolar. The metaconid lies distinctly behind the protoconid and is thus visible in side view. The heel of the tooth is somewhat basin-shaped, with a rim formed by five cusps, of which the metaconid is the antero-internal one. There is considerable variation in the development of the minute first premolar in both jaws, as mentioned later, for in some skulls it is absent, in others present on one or both sides of upper or lower or both jaws. Otherwise the dental formula is as in *Meles*. With age the hind margin of the glenoid cavity becomes extended forward so that it may be impossible to disarticulate the jaw, while at the same time the temporal ridges move toward the median line and eventually form a high crest in old animals. The genotype is *A. collaris* F. Cuvier, from the mountains of northeastern India between Bhutan and Hindustan.

The Hog-nosed Badger of northeastern India extends its range across southern China, apparently without important change of characters, notwithstanding the various names that have been bestowed upon it. In North China, however, it is represented by a distinct subspecies.

188. **Arctonyx collaris collaris** F. Cuvier

HOG-NOSED BADGER; SAND BADGER

Arctonyx collaris F. Cuvier, in Geoffroy and Cuvier, Hist. Nat. des Mammifères, vol. 3, pt. 51, pl. and 2 pp. text, 1825.
Meles (Arctonyx) obscurus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, pp. 200, 202, 1868-74.
Arctonyx obscurus Milne-Edwards, *ibid.*, p. 338, pl. 58, fig. 2; pl. 62. Thomas, Proc. Zool. Soc. London, 1912, p. 134.
Meles albogularis Hilzheimer, Abh. u. Ber. Mus. f. Natur- u. Heimatk., Magdeburg, vol. 1, p. 183, 1906.
Arctonyx leucolæmus orestes Thomas, Proc. Zool. Soc. London, 1911, p. 688. Tsingling Mts.
Arctonyx leucolæmus arestes Sowerby, Fur and Feather in North China, p. 48, 1914 (*lapsus*).
Arctonyx obscurus incultus Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 395, 1922. Anhwei.
Arctonyx leucolæmus obscurus A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 29, 1929.
Arctonyx collaris collaris G. M. Allen, Amer. Mus. Novitates, no. 358, p. 10, 1929.

Type specimen:—The new genus and species represented by this badger were based by F. Cuvier on a colored drawing sent him by M. Alfred Duvaucel, and reproduced in the "Histoire Naturelle des Mammifères." The figure shows the tail very thinly clad with hair, which was perhaps a result of wear in captivity, for the animals from which Duvaucel made his figure were a pair in a menagerie at Barrackpore, said to have been captured in the mountains dividing Bhutan from Hindustan.

Description:—A large, rather short-limbed badger, with pale claws. A white stripe runs from the nose-pad back along the midline of the forehead to the neck; a second shorter white stripe passes along the side of each cheek below the eye to the sides of the neck, merging with the whitish of the neck. Throat, ears and tail white; feet and middle of belly black. The fur of the back is white at base with a black terminal portion, or this black band may be succeeded by a white or a yellowish tip, so that specimens from the same locality may be blackish on the back, or largely grizzled with gray, or often with a yellowish tinge. In some specimens the nape and shoulders are nearly white.

The skull characters have already been mentioned. There is frequently a minute spicular first premolar present. No. 41475 (A.M.N.H.) from Fukien, a subadult, and No. 22.9.1.36 (B.M.) from Likiang have this tooth present on both sides in the lower jaw but not in the upper. No. 57373 has not only both these teeth present, but in the upper jaw the first premolar on the right side. One from Ichang in the British Museum has the tooth on the left side above and on both sides in the lower jaw. The palate may be bounded at its posterior rim by an even arch, but in two out of three skulls this is prolonged as a narrow median cleft.

Measurements:—No fresh measurements are at hand, but a skin is about 650 mm. in length of head and body; tail about 150; foot with claw about 95. Thomas (1922b) gives for the type of his *A. o. incultus:* head and body, about 700 mm.; tail, 170; hind foot, 89.

CRANIAL MEASUREMENTS OF *ARCTONYX COLLARIS COLLARIS*

No.	Greatest length, occiput to gnathion	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
41475	155.0	138.3	104.5	81.6	74.3	43.0	51.7	60.0	—	Fukien
57373	151.0	134.0	101.0	75.5	75.5	42.0	50.0	58.2	♂	Fukien
84390	144.0	130.0	98.0	78.0	76.0	43.3	47.5	56.0	♂	Fukien
84391	139.4	125.8	88.0	89.1	81.5	44.0	49.0	55.8	♂	Fukien
85025	138.6	125.0	89.0	87.0	80.0	43.6	46.4	54.4	♂	Fukien
2.6.10.25 BM (type of *A. incultus*)	133.3	116.2	90.4	89.5	72.4	38.6	43.7	51.0	♂	Anhwei
2.6.10.33 BM	130.7	118.5	83.4	71.2	67.5	37.9	44.2	51.9	♂	Hupeh
23.4.1.26 BM	126.2	112.5	78.5	——	63.0	36.0	40.3	47.0	Im. ♂	Yunnan
60190	139.5	127.5	90.0	83.5	77.0	41.6	47.4	53.2	♀	Fukien
89.3.1.1 BM	136.5	123.2	88.5	75.8	64.7	37.1	47.0	54.5	Ad. ♀	Hupeh
22.9.1.36 BM	122.4	112.6	78.9	68.9	60.0	37.2	39.5	46.6	Im. ♀	Yunnan
11.9.8.43 BM	131.8	116.8	81.0	70.3	69.1	37.3	42.0	——	♀	Szechwan
11.6.1.6 BM (type of *A. l. orestes*)	131.7	121.6	86.1	71.0	70.3	40.7	44.5	51.6	Ad. ♀	Shensi

Nomenclature:—The precise relationships of the various described Hog-nosed Badgers still require a more careful working out. It seems clear, however, that the large species of the eastern Himalayas named *A. collaris* by Cuvier, occurs without important change quite across southern China to the coast of Fukien. There is considerable individual variation in color, for skins from the same region may include those having white head-markings, black nape and back, to those with the facial stripes tinged with ochraceous, the nape, shoulders, and all the hairs of the back white-tipped or ochraceous-tipped. A light-colored specimen of the latter type served as the basis for Thomas's *A. leucolæmus orestes* from the Tsingling Mountains, Shensi. Milne-Edwards's *A. obscurus* is one of the darker individuals, and a synonym of *collaris*. Anderson, who examined the type from western China, regarded it as a young animal identical with *A. albogularis*, a synonym of *A. collaris*. Thomas, in 1922, described as *A. obscurus incultus* an old male from Anhwei, stating that it differed from the typical race in its thin coat and the greater inflation of the palate. The first character, however, is doubtless seasonal, while the degree of inflation of the palate is a matter of individual variation, for when a series of skulls is examined, hardly two are found to be quite alike in this respect, but the older individuals are usually the more inflated. It

does not seem that more than a single race can be distinguished in South China, with a second in North China.

Occurrence and Habits:—The Hog-nosed Badger was reported from the Tengyueh region of extreme western Yunnan as long ago as 1879 by Anderson. Thence it apparently extends eastward across southern China to the coastal province of Fukien, and northward to the Yangtze basin, and the Tsingling Range. Somewhere along this boundary it doubtless grades into the northern race, *A. c. leucolæmus*. The American Museum Asiatic Expeditions secured several skins at Likiang, Yunnan, and Thomas (1922b, 1923) has also recorded it from that range as well as from Weichow, Si Ho, western Szechwan. Other localities in Szechwan are Omei Shan and Wa Shan whence the U. S. National Museum has specimens (A. B. Howell, 1929). The Museum of Comparative Zoölogy has one from Hupeh, and Thomas mentions specimens in the British Museum from Ichang, with which he compared his type of *A. o. incultus* from Chinteh (Tsingte), Anhwei, 150 km. west of Hangchow. Mr. Clifford H. Pope writes that one of the specimens obtained at Futsing, Fukien, was trapped at the mouth of a hole in an earth bank at the foot of the wooded range of mountains surrounding Lingshih monastery. The animal is said by the Chinese to be a deep burrower and difficult to secure, though not uncommon. Probably the specimens recorded by A. B. Howell (1929) as *A. leucolæmus* from Ningpo, Chekiang, and from Kuatun, Fukien, are referable to typical *A. c. collaris*, as seem to be also a skin from Tunglu, Chekiang, and others from Fukien, in the American Museum collections. Very little seems to be recorded as to the habits of this species.

Specimens examined:—Twenty, as follows:

Chekiang: Tunglu, 1.
Anhwei: Chinteh, 1 (B.M.), type of *incultus*.
Hupeh: 1 (M.C.Z.); Ichang, 2 (B.M.).
Fukien: Chungan, 3; Futsing, 1; Yenping, 3.
Shensi: Tsingling Mountains, 1 (B.M.), type of *orestes*.
Yunnan: Likiang, 4 (skins only); 2 (B.M.).
Szechwan: Weichow, 1 (B.M.).

189. **Arctonyx collaris leucolæmus** (Milne-Edwards)

NORTH CHINA HOG-NOSED BADGER

Meles leucolæmus Milne-Edwards, Ann. des. Sci. Nat., Zool., ser. 5, vol. 8, p. 374, 1867.
Meles (Arctonyx) leucolæmus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 195, pl. 24; pl. 26, figs. 1, 2; pl. 27, figs. 1, 2; pl. 28, figs. 1, 2, 1868-74 (1871).
Arctonyx leucolæmus Buechner, Bull. Acad. Imp. Sci. St. Pétersbourg, vol. 34 (new ser., vol. 2), p. 103 (Mélanges Biol., vol. 13, p. 149), 1892.
Arctonyx leucolæmus milne-edwardsii Lönnberg, Ann. Mag. Nat. Hist., ser. 9, vol. 11, pp. 322-326, 1923.
Arctonyx leucolæmus leucolæmus A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 29, 1929.
Arctonyx collaris leucolæmus G. M. Allen, Amer. Mus. Novitates, no. 358, p. 11, 1929.

Type specimen:—The specimen on which Milne-Edwards based his account

of this badger was sent to the Paris Museum by Père Armand David from the vicinity of Peiping, Hopei, China, and is presumably still in that institution.

Description:—This northern race of the Hog-nosed Badger is distinguished by its slightly smaller size (skull length about 125 mm.) and by having the white collar complete across the nape; usually, too, the dark coloring of the back extends on to the basal part of the tail. As compared with the typical race, the specimens at hand agree in having little or no white tipping to the hairs of the back, but instead these are white for the basal three-fifths, then blackish brown, although there are white-tipped hairs across the shoulders immediately behind the white nape. The dark-tipped hairs of the back extend on to the tail for the greater part of its length in diminishing amount toward the terminal half. Another point of difference is that in *A. c. leucolæmus* the white stripe below the eye does not reach the lip, but it does in typical *A. collaris*.

The skull, even in aged specimens, is considerably smaller than in the southern race, and the posterior, tubular prolongation of the palate shows very little inflation, which is so marked a characteristic of the latter. As in the typical race, the minute first premolar may or may not be present, and is apparently deciduous, falling out with age. Its presence or absence in skulls of both races that I have examined is shown in the following table:

PRESENCE OF PM^1 AND PM_1

No.	Locality	In upper jaw	In lower jaw	Subspecies
45295	Hopei	None	Right side only	*A. c. leucolæmus*
45296	Hopei	None	On both sides	*A. c. leucolæmus*
57373	Fukien	On right side	On both sides	*A. c. collaris*
60190	Fukien	None	On both sides	*A. c. collaris*
84390	Fukien	None	On both sides	*A. c. collaris*
84391	Fukien	On left side	On both sides	*A. c. collaris*
85025	Fukien	On both sides	On both sides	*A. c. collaris*
41475	Fukien	None	On both sides	*A. c. collaris*
7557 MCZ	Hupeh	None	On both sides	*A. c. collaris*

It is obvious that this tooth is usually present on both sides of the lower jaw, but usually absent in the upper. Milne-Edwards (1868-74, p. 340), however, describes and figures a specimen from Shensi in which both pairs are present, and Lönnberg (1923a) has more recently noted the same peculiarity in a specimen from southern Kansu, to which, chiefly for this reason, he has given the name *A. l. milne-edwardsii*. There can be no doubt, however, that this is a variable character, of no systematic importance.

Measurements:—Few measurements of fresh specimens are available. Lönnberg (1923a) gives for his specimen from Kansu: head and body, 680 mm.; tail, 140.

CRANIAL MEASUREMENTS OF *ARCTONYX COLLARIS LEUCOLÆMUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
45295	127	114	77.5	75.5	68.0	37.0	44.0	50.0	Hopei
45296	——	——	——	81.0	69.5	38.4	43.2	50.4	Hopei
LÖNNBERG	123	112	79.0	70.0	69.0	——	——	——	Kansu

Occurrence and Habits:—This form of the Hog-nosed Badger is apparently distinguished by its smaller size, uniformly darker back with white nape, and by the shorter suborbital white mark, which does not extend to the lower lip. It is apparently a well-marked race, characteristic of northern China, beyond which its range does not seem to extend. The type was from Peiping or its neighborhood, in Hopei, and the American Museum Asiatic Expeditions secured three specimens from Tungling, which are, therefore, practically topotypes. In addition, Jacobi (1922) has recorded a female brought in at Jehol (Chengteh), more than one hundred miles northeast of Peiping, which is the most northerly record for this animal that I have found. This female on April 30 had four small young, with their eyes still unopened. To the westward this badger seems to range across southern Shansi and Shensi into southern Kansu, whence came Lönnberg's type of *milne-edwardsii*, taken in the Min Shan. Buechner in 1892 recorded this badger from the Ssigu district, Kansu, which must be nearly its northwestern limit. Here it was found by Potanin and Berezovski at altitudes of from 9,000 to 10,000 feet in burrows, under boulders. A. B. Howell (1929) has recorded specimens of this badger from Min Shan, in Kansu, and from eighty miles east of Peiping, in the U. S. National Museum. There seem to be very few records of the hog-badger from Shansi and Shensi, the former province being perhaps largely unsuited to it. In southern Shensi, however, Père David secured a specimen which he sent to the Paris Museum, where Milne-Edwards regarded it as *A. obscurus*. No doubt this race intergrades with the typical form somewhere along the northern part of the Yangtze basin.

Specimens examined:—The following:
Hopei: Eastern Tombs, 3.

Genus **Lutra** Brünnich

OTTERS

Lutra Brünnich, Zoologiæ Fundamenta, p. 34, 1772.

The otters are large members of the weasel family that have become highly modified for aquatic life. The head is broad and somewhat flattened, the ears low and rounded, the neck thick, the body relatively slender, the tail long, muscular, and flexible, tapering slightly toward the end. The limbs are

rather short, and the fingers of both fore and hind feet are webbed for swimming. The claws are short and rather weak. The fur is short and dense, with a fine under fur and a coarser over fur, the latter of strong and polished hairs that shed the water. At the sides of the muzzle, the vibrissæ are very stiff and of medium length, less conspicuous than in some of the aquatic mammals. The skull is characterized by the very short, blunt snout, narrow interorbital region, with slightly projecting postorbital processes, and a large oval, and rather flattened brain case. With age the bones of the skull fuse intimately and all sutures disappear, that separating the nasal bones being one of the last to be obliterated on the dorsal surface, while on the ventral side, the basal suture remains open during growth. In ventral aspect, the postpalatal prolongation of the nasal passage forms only a short tube, and the hamular processes of the pterygoids are distant from the auditory bullæ by at least their width apart. The incisors form a transverse row, with the outer tooth on each side twice the size of the others which are subequal. The canines are nearly vertical, the upper slightly longer than the lower. Of the four upper premolars, the first is very small, closely appressed against the inner side of the canine nearly at its middle point. The second and third upper premolars are larger, with sharp-pointed, compressed conical crowns, while the fourth is much larger, with an outer blade-like portion and a wide, rounded, inner ledge. The upper molar is rectangular with rounded corners, the two outer cusps separated by a wide flat valley from the two inner. In the lower jaw there are but three premolars; the first molar is large and narrowed, its paraconid and protoconid with compressed cutting edges, shearing against the outer cusps of the last upper premolar. The metaconid is nearly as large and sharp as the paraconid and partly hidden in side view behind the protoconid. The heel of the tooth is much lower, and slopes inward on the inner side. The tooth formula is: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{3}$ m.$\frac{1}{2}$ = 36. The genotype is *Lutra lutra* (Linnæus).

The common otter of Europe is closely related to that of eastern Asia, and extends with little modification across northern Asia, into China, where it is represented by probably two subspecies. A second species occurs in southwestern China. The clawless otters constitute a separate genus.

KEY TO THE CHINESE SPECIES OF *Lutra*

A. Upper border of the nose-pad tridentate, with three nearly equal pointed projections.
   a. Teeth smaller, upper cheek teeth about 34 mm..... *L. lutra chinensis*
   b. Teeth larger, upper cheek teeth about 38 mm..... *L. lutra nair*

B. Upper border of the nose-pad straight across; size rather smaller; postorbital isthmus inflated..... *L. tarayensis*

190. **Lutra lutra chinensis** Gray

EASTERN CHINESE OTTER

Lutra chinensis Gray, Mag. Nat. Hist., ser. 2, vol. 1, p. 580, 1837. Swinhoe, Proc. Zool. Soc. London, 1870, p. 624.
?*Lutra nair* Sclater, Proc. Zool. Soc. London, 1861, p. 390.
Lutra vulgaris Buechner, Bull. Acad. Imp. Sci., St. Pétersbourg, vol. 34 (new ser., vol. 2), p. 103, 1892.
Lutra sinensis Trouessart, Cat. Mamm. Viv. Foss., p. 283, 1897 (as synonym of *L. lutra*).
Lutra lutra J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 430, 1909.
Lutra lutra chinensis G. M. Allen, Amer. Mus. Novitates, no. 358, p. 12, 1929.

Type specimen:—The type of Gray's *Lutra chinensis* was sent from China to the British Museum by John Reeves, and hence probably came from the neighborhood of Canton.

Description:—An otter with well-developed claws, and the dorsal outline of the nose-pad nearly W-shaped, with a median point separated by two V-like depressions from the lateral wings. The general color of the body above, including the tail, is light chocolate brown, paler than in the European otter. The lips and the longer hairs of the throat and middle portion of the belly are pale gray, partly concealing the pale brown of the shorter under fur.

The skull of the Eastern Chinese Otter is smaller than that of the European or the Indian race, with apparently smaller teeth and shorter tooth rows. The frontal region between the orbits is very narrow, and practically parallel-sided, except for the slight projection caused by the blunt postorbital processes, instead of being conspicuously inflated as in *L. tarayensis*.

Measurements:—No measurements of fresh specimens from China are available, but a tanned skin, immature, but nearly full grown, is about 950 mm. in total length, of which the tail is about 300.

CRANIAL MEASUREMENTS OF *LUTRA LUTRA CHINENSIS*

No.	Condylobasal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Postorbital constriction	Upper cheek teeth	Lower cheek teeth	Sex	Locality
44782	108.0	99.5	49.5	63.0	57.0	32.0	15.0	34.0	41.5	♂	Fukien
60097	100.0	93.0	45.0	57.0	51.5	30.2	14.0	31.8	38.0	♀	Hainan
24086 MCZ	96.5	88.4	43.6	54.4	49.7	29.3	16.0	32.0	37.5	—	Szechwan?
62.12.24.5 BM	112.0	104.5	49.7	67.2	60.2	31.5	——	33.8	39.4	♂?	Fukien
94.9.1.37 BM	107.5	100.0	45.8	60.6	56.3	32.3	——	33.3	39.8	♀?	—

Nomenclature:—There seems to be no doubt that the otter of eastern China is somewhat smaller and paler than that of Europe, and that Gray's name applies to it. The otters of the *Lutra lutra* group are distinguished by

having the upper edge of the nose-pad cleft into a trident, instead of being straight across as in the species *L. tarayensis*. Anderson (1879) reviewed the eastern otters with considerable care, and pointed out that the two species are further distinguished by skull characters, the frontal region between the orbits being laterally swollen in the latter, and nearly parallel-sided in the former. Hodgson believed there were no fewer than seven species in Nepal, ranging into the Indian and Himalayan region, but Wroughton (Journ. Bombay Nat. Hist. Soc., vol. 26, p. 349, 1919) has shown that these may be reduced, as Anderson had indicated, and gives a key to the characters. The latter author also pointed out clearly that *Lutra nair* of India is one of the *L. lutra* group, and it is doubtless merely a subspecies of the European Otter. Thomas has recorded it from Yunnan.

Occurrence and Habits:—Otters occur sparingly in the vicinity of the larger streams and lakes all over China, but obviously are absent from the more or less waterless areas, as the Gobi. They frequent the rocky coasts of the seaboard also, living on fish chiefly. The Chinese race of the Common Otter doubtless intergrades in northern China or to the northward with the typical form, which seems to extend without important change, quite across northern Asia. It is true, however, that available specimens for comparison are hardly yet sufficient for a careful study of the geographic variation of the group. No records are at hand for northern China in Hopei, though it doubtless is present in small numbers. A. B. Howell (1929) mentions a skull in the U. S. National Museum from Sianfu, Shensi, and J. A. Allen (1909a) a female specimen from Yumonko, Taipai Shan, in the same province. The latter specimen is said to represent "probably the *Lutra hanensis* Matschie," but, as pointed out later, this may not be the case. Matschie (1908) has recorded one in the Berlin Museum from Ningpo, Chekiang, and Sowerby (1924) reported one seen January 27, 1924, in Kiangsu, not far from Shanghai. It occurs in the mountain streams of western China rather sparingly. Buechner (1892) records the skin of a young one secured by the Berezovski Expedition in the Choihsien region of western Kansu, and according to Weigold (1923) one was reported seen by a missionary at Batang, in extreme western Szechwan. Without specimens, however, it is not possible to determine the species or races. Swinhoe (1870c, p. 624) wrote that the otter is found all over the South China sea-coasts and inland as well. He had a skin from Hainan, and Mr. Clifford H. Pope, who made a splendid collection of mammals on that island for the American Museum in 1923, also procured a specimen there. He adds in a manuscript note that when collecting fish some six miles from Namfong, in the "Golden River" (Hainan's largest stream), his native hunter showed him half-eaten fish lying on the rocks and declared they were left there by otters. From the number of such remains seen in one place, and the abundance

of skins offered for sale at Namfong, he judged that otter are common on the island. The Chinese in catching them often use a racket-shaped net on a handle about six feet long. It is not clear how far south in eastern China this otter ranges, but it doubtless reaches the subtropics. Mell (1922) writing from Canton, mentions seeing otters there, although the species is not altogether certain. At all events he records an individual of this race as seen one moonlight night near that city, and another that was caught in a net an hour west of there. In a broad, swift mountain stream at Fungwahn, a young female was caught, and on May 20 a young one with eyes still closed was taken three-quarters of an hour's journey from the same place. Its whimpering cries led to its discovery in a hollow among rocks in tall grass, some three meters from the brink of a stream. A very young one of this species was taken August 5 in Hainan (J. A. Allen, 1909). Various observers have mentioned the use of trained otters in catching fish in China. Swinhoe (1870c) speaks of one he saw in the Ichang Gorges, over a thousand miles up the Yangtze, that would drive fish under a large cast net. In comparison with other members of the family, otters seem more tractable and make intelligent pets.

A specimen, apparently a female, in the British Museum, from Foochow, was taken in a fishing net July 10, 1890, and as noted on the label, weighed ten and a half pounds.

Specimens examined:—Six, as follows:

Central China: 1 (M.C.Z.).
Fukien: Yenping, 1 (skin); Yuki, 1 (skull); Foochow, 1 (B.M.); Amoy, 1 (B.M.).
Hainan: Nodoa, 1.

191. **Lutra lutra nair** F. Cuvier

HIMALAYAN OTTER

Lutra nair F. Cuvier, Dictionnaire des Sci. Nat., vol. 27, p. 247, 1823.
Lutra lutra nair Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 396, 1922.

Type specimen:—The type came from Pondicherry, Madras, India,whence it was sent to the Paris Museum by Leschenault. The skull of this specimen was removed from the skin and made available for the excellent figures showing it in four aspects, in J. Anderson's (1879, pl. 11) "Yunnan Researches."

Description:—The Indian race of the common otter apparently is closely similar in its coloration to the Chinese race, with a slight grizzling of the umber brown dorsal surfaces, whitish lips and throat and with the longer belly hairs chiefly white. It seems to differ from the available specimens of *L. l. chinensis* mainly in its larger teeth, and possibly in larger dimensions of skull and body. Compared with the excellent figures of the type skull in Anderson's plate, the

teeth of otters from eastern China are individually smaller, the tooth row less. In both, the interorbital area is uninflated.

Measurements:—Anderson gives the measurements of a mounted specimen as: head and body, 27 inches (685 mm.); tail, 15.75 inches (400 mm.). The following dimensions are taken from his figure of the type skull: greatest length, 116 mm.; basal length, 105; palatal length, 51; zygomatic width, 71; mastoid width, 63; width outside molars, 38; upper cheek teeth, 38; lower cheek teeth, 42; combined length of pm^4 and m^1 on outer edge, 18.5; upper molar, outer edge, 7.6; upper molar, longest diagonal, 14.3 (10.5, 10, in two skulls of *L. l. chinensis*).

Occurrence and Habits:—The few specimens of otters available for study render it difficult to assign names definitely to those of western and southern China, but Thomas (1922b, p. 396) has identified as *Lutra lutra nair* a female secured by George Forrest in the Mekong valley, 28° north latitude, Yunnan, and sent by him to the British Museum. This identification definitely extends the range of the Indian race into western China. Sclater, as long ago as 1861, published a letter from Swinhoe on the capture of an otter at Amoy and supposed it to be *Lutra nair*, but specimens from eastern China indicate that the skull and especially the teeth of these animals are considerably smaller than those of *L. l. nair*, as far as can be judged from Anderson's careful figures of the type. I have, therefore, provisionally followed Thomas in regarding Yunnan specimens as representing the Indian race, though it may later prove that they are intermediate or even identical with eastern individuals. Anderson (1879, p. 211), although he did not think that *L. nair* extended into Burma, nevertheless secured numbers of native skins on the borders of western Yunnan, representing apparently two species, of which the smaller was probably the race under discussion, the larger *L. tarayensis*. Since no skulls were to be had, he could not be certain of the identity of his specimens.

Specimens examined:—None.

192. **Lutra tarayensis** Hodgson

Lutra tarayensis Hodgson, Journ. Asiatic Soc. Bengal, vol. 8, p. 319, 1839; Ann. Nat. Hist., ser. 1, vol. 5, p. 28, 1840.

Lutra monticola Anderson, Anat. and Zool. Researches Western Yunnan, p. 207, pl. 12, figs. 1-3, 1879.

?*Lutra hanensis* Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 150, 1908.

Type specimen:—Hodgson's types were sent to the British Museum where now the original specimen of his *Lutra tarayensis* must be, but Anderson, who looked for it, wrote in 1879 that his specimens were "unfortunately seemingly without names, and along with them a series of Otter skulls the species of which were not stated," so that it was not possible to recognize the types.

The type of his *L. tarayensis* as well as of his *L. monticolus* (as originally spelt) were from Nepal.

Description:—This is a larger otter than *L. l. nair*, with the upper border of the naked nose-pad forming a straight transverse line, instead of a W. Anderson describes the color as "more rufous umber-brown than *L. nair*," without any tendency to grizzling; the under surface is only somewhat hoary, well washed with brown. "The chin and edge of the lips are whitish, and the silvery hoary on the sides of the head, on the throat, and on the under surface of the neck and on the chest, is marked." The tail is of the same color as the back all around.

Anderson points out that the distinctive features of the skull are, "the considerable swelling of the post-orbital contraction of the frontal," well seen in dorsal view, and the nearly straight instead of depressed profile of the rostrum, which is almost a continuation of the same plane as that of the brain case, instead of being deflected downward. The rostrum itself is proportionally shorter and the teeth larger as compared with *L. l. nair*.

The skull of a fine adult of this otter in the British Museum has a noticeably long, narrow, and parallel-sided postorbital region, the width of which is about the same as the interorbital distance, and is slightly swollen. The teeth are large and heavy.

Measurements:—Anderson states that the skeleton of a female, as mounted, measured: from the tip of the premaxillaries to the end of the sacral vertebræ, 23.25 inches (590 mm.); the tail, 17.75 inches (450 mm.). The tail is apparently proportionally longer than in the *L. lutra* group.

The measurements of a female skull of this species are given (under *L. monticola*) as follows, reduced to millimeters: foramen magnum to tip of premaxillaries, 110.5; palatal length, 55.5; zygomatic width, 74; orbit to end of nasals, 14; upper tooth row, 48; lower tooth row, 50.8.

A skull in the British Museum from Chindwin, Burma, measures as follows:

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Locality
BM	126.5	106.0	60.8	79.5	66.8	39.3	43.7	51.6	Burma

Occurrence and Habits:—There can be little doubt that this otter occurs along with *L. l. nair* in southwestern China, but almost nothing is known of it. Probably the two are usually confused, but skins may be identified by the characteristic shape of the nose-pad. Anderson states: "In Western Yunnan, I obtained numerous, perfect Otter skins belonging to two distinct species, but unfortunately no skulls." The larger of the two, which he calls *L. monticola*, seems to be the present species, the smaller, *L. l. nair*. The very different

skull, with straight dorsal profile, short rostrum, inflated interorbital portion, and large teeth, is excellently shown in Anderson's plate (1879, pl. 12, figs. 1-3). There seems to be little doubt that Hodgson's *L. tarayensis*, described on the same page as his *L. monticolus*, is really the same animal, for which, therefore, the former name, coming first on the page, may best be used. He described its tail as being two-thirds the length of head and body, and supposed it was a lowland animal while *L. monticolus* lived in the hills. In addition to the rather definite record for Yunnan by Anderson, Pousargues (1896a, p. 2) has referred to *L. monticola*, doubtfully, a skin without skull from Yunnan. The identity of the otter described by Matschie as *Lutra hanensis* from a trade skin bought by the Filchner Expedition at Hinganfu, southern Shensi, is still unsettled. It is probably quite the same as *L. l. chinensis*, having a tail one-half the length of head and body, but Matschie describes the nose-pad as having its upper border straight across, which, if correct, would seem to indicate *L. tarayensis*. The origin of trade skins in China is not always the vicinity of the place of sale, so that even if this identification is correct, it does not necessarily establish the presence of the species in Shensi.

Specimens examined:—None.

Genus **Micraonyx** J. A. Allen

Micraonyx J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 47, p. 94, pl. 9, fig. 1, text figs. 5C-C^1, 6, 7, 1924.
Aonyx Swinhoe, Proc. Zool. Soc. London, 1870, p. 229 (not of Lesson).

The so-called clawless otters of the East are smaller than the members of the genus *Lutra*, and until recently were usually placed in the genus or subgenus *Aonyx*, but the late J. A. Allen showed that the latter name is based exclusively upon the South African *A. capensis*, a large animal differing in so many details of structure that he erected the new genus *Micraonyx* for the eastern species, *M. cinerea*. The chief diagnostic points are: the small size (total length of adults about 560 mm.), the tail broad at base, but rapidly tapering to a slender tip, which becomes nearly bare especially on the ventral side; pads of hands and feet large, covering the whole of the naked areas, and greatly thickened; claws present, but very weak; first upper premolar (pm^1) usually absent; postorbital processes small but definitely developed, more so than in *Lutra*. In general the skull is short and broad in proportion, the teeth relatively large. The dental formula is usually: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{3}{3}$ m.$\frac{1}{2}$ = 34, and so with one less pair of premolars than in *Lutra*. The type and only species is *M. cinerea* (Illiger), which occurs in southern India, China, and south to the East Indies.

193. **Micraonyx cinerea** (Illiger)

SMALL-CLAWED OTTER

Lutra cinerea Illiger, Abh. Kön. Preuss. Akad. Wiss., Berlin, for 1811, p. 99, 1815. J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 480, 1906.
Lutra (Hydrogale) swinhoei Gray, Proc. Zool. Soc. London, 1867, p. 182.
Aonyx leptonyx Horsfield, in Swinhoe, Proc. Zool. Soc. London, 1870, p. 229.
Lutra swinhoei Swinhoe, Proc. Zool. Soc. London, 1870, p. 625.
Lutra (Aonyx) leptonyx Anderson, Anat. and Zool. Researches Western Yunnan, p. 213, 1879.
Micraonyx cinerea J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 47, p. 93, 1924.

Type specimen:—Unknown.

Description:—The coloration is in general similar to that of the otters of the genus *Lutra*, that is, the upper parts are uniformly "dark brown without head markings or white-tipped hairs; under parts somewhat paler, becoming whitish on the sides of neck, cheeks, chin and throat." The greatly developed pads on the soles of fore and hind feet, combined with the much reduced claws, and the nose-pad with its upper border straight across, will suffice to distinguish it externally.

The distinctive characters of the skull, as already mentioned, are its small size, the very short rostrum, prominent postorbital processes, deep postorbital constriction, broad brain case anteriorly, and very large teeth, with usually one less premolar in the upper jaw than in *Lutra*.

Measurements:—No Chinese specimens with flesh measurements are at hand. J. A. Allen (Bull. Amer. Mus. Nat. Hist., vol. 47, p. 94, 1924) gives for specimens from southeastern Asia a total length of about 560 mm.; weight about 11 to 13 pounds.

The average skull dimensions for six East Indian skulls he gives as follows: condylobasal length, 89.2 mm.; zygomatic width, 61.7; mastoid width, 53.9; width of brain case, 47.5; interorbital width, 18. The molars are so large that the breadth of an upper molar slightly exceeds the distance between the tooth rows.

In the skull described, the upper cheek teeth (c-m^1) measure 32.2 mm.; p^2-m^1, 26.8; the large upper premolar, p^4, 12.8 by 13.8; the upper molar, 8.8 by 12.2. Lower cheek teeth (c-m_2), 37.6; p_2-m_2, 27; first molar, 13.4 by 8.0; second molar, 4.9 by 6.3.

Occurrence and Habits:—The small-clawed otter is apparently distributed sparingly all over southern China, from the western borders of Yunnan eastward to the Pacific coast in Fukien Province and Hainan. Nevertheless there are very few definite records for it. The first seems to be that of Swinhoe who sent one to J. E. Gray at the British Museum about 1867. This was described as a new species, *Lutra (Hydrogale) swinhoei*, by Gray, who supposed it came from Formosa, but in reality, as Swinhoe later (1870c, p. 625) men-

tioned, it was from the island Gawkang, near Amoy in Fukien. It was an immature animal, and was alive for some time in captivity. Swinhoe mentions that when hungry it gave vent to sharp jarring notes but if left alone it made louder sounds like those of a young chicken. At a trading station in Hainan, Swinhoe (1870a, p. 229) procured three skins and noted the differences between these and the skins of other otters, the minute pointless claws, toes longer and more fully webbed than in *Aonyx*, and the relatively long first toe of the hind foot. He believed that it was different from Malacca specimens in its longer tail and lack of a white throat. He adds that the bones of this otter found in caverns are ground by the Chinese and applied to wounds from poisoned arrows in order to absorb the poison. The natives in Hainan believe that this is a cross between the common otter and the gibbon, and it is there known as "Mountain otter." Anderson (1879, p. 213) records that he found otters of this genus in western Yunnan, in the hills to the eastward of Bhamo, Burma. Two skins that he procured seemed brighter colored than the average of *Micraonyx cinerea*.

Other than these, there are no definite records of the small-clawed otters in southern China.

Writing of their occurrence in Borneo, E. Banks (Journ. Malayan Branch Roy. Asiatic Soc., vol. 9, p. 61, 1931) says that "they may be met with on the seashore or far upriver in the small side streams; this is the best place to see them, for the roar of the water drowns the noise of one's movements and the otters may be easily observed nosing about the water's edge. Sometimes solitary, sometimes in families of 5 or 6 they all take to the jungle in a sharp clumsy gallop on being disturbed, for the water as a rule is too shallow for them to find refuge."

Specimens examined:—None.

Family VIVERRIDÆ

CIVETS AND MUNGOOSES

The Viverridæ are at the present time confined to the warmer parts of the Old World, and more or less take the place of the boreal Mustelidæ in the tropics and subtropics. The larger species are somewhat bigger than a house cat, the smaller hardly larger than a good-sized rat, of long slender build, and weasel-like form, short legs, small rounded feet, with curved and more or less retractile claws. The first toe is much shorter than the others, and there are usually the full five on each foot. The pads of the feet are naked, with the rest of the sole hairy. The skull is usually rather elongate, with narrowed rostrum, the orbit marked off by a constriction just behind the supra-orbital processes, which in the subfamily Viverrinæ, containing the

civets and paradoxures, are short but obvious, while in the subfamily Herpestinæ, containing the mungooses, they are much longer, nearly or quite meeting the upward process of the jugal to form a bony orbital ring. The audital bulla is elongate, divided externally into an anterior and a posterior portion by an oblique furrow, and bounded in the rear by a broad, and bluntly triangular paroccipital process. The teeth are of the carnivorous type with the fourth upper premolar and the first lower molar modified as carnassials. The upper molars are usually elongate in a transverse axis, with the three principal cones evident, but the hypocone obsolete. The first lower molar has the protoconid and paraconid high and compressed for shearing against the blade of the upper carnassial, the metaconid a prominent pointed cusp partly hidden in outer aspect by the protoconid, while the posterior part of the tooth forms a low heel with three bordering cusps. Four genera of civets and paradoxures, and one genus of mungooses are known to occur in the warmer parts of southern China. They may be identified by the following key.

KEY TO THE GENERA OF CHINESE VIVERRIDÆ

A. The tail with alternate cross-bands of black and white (or buff).
   a. Size large, skull over 130 mm. in length ..... *Viverra*
   b. Size smaller, skull less than 130 mm. in length ..... *Viverricula*

B. The tail without alternating rings of black and white.
   a. Head more or less black with white markings; supraorbital processes very short.
      a′. Body with three to five well-marked median black stripes; interorbital region of skull much constricted ..... *Paradoxurus*
      b′. Body without longitudinal stripes; interorbital region not conspicuously constricted ..... *Paguma*
   b. Head without black areas; supraorbital processes well developed, nearly or quite meeting the jugal processes to form a bony ring about the orbit .... *Herpestes*

Genus **Viverra** Linnæus

CIVET

Viverra Linnæus, Syst. Nat., ed. 10, vol. 1, p. 43, 1758.

The Civet of India and the East has lately been shown to differ in certain structural characters from the rather similar African species, so that the latter has been separated as *Civettictis*, leaving *Viverra* as the generic name of the oriental animal. It is easily recognized by its large size, with full black-and-white ringed tail, blackish feet and a broad black band across the lower throat, set off by transverse areas of white. A prominent crest of longer erectile hairs extends down the middle of the back. The skull is elongate, with strong zygomatic arches, blunt but prominent postorbital processes, and a marked postorbital constriction. The audital bullæ are relatively small, the total

length of their inflated posterior portion, including the paroccipital process, equaling the distance between tips of the upper canines. This posterior portion is evenly rounded, lacking a keel, and is separated from the anterior meatal chamber by an oblique groove. The palate is slightly produced beyond the level of the maxillary, which ends in a small lobe on each side, well marked off. The incisors form, in the upper jaw, an evenly convex row; the canine is long and very slightly compressed from side to side; the first premolar in each jaw is small, the second and third upper premolars larger, subequal, triangular in side view and compressed. The fourth upper premolar is sectorial, with a small antero-external cusp, a high median cusp with cutting edge, and a posterior ridge. There is a prominent antero-internal cusp as in the usual carnassial tooth. The molars seem normally to be two in the upper and in the lower jaw on each side, but are occasionally three. They are elongated transversely in the upper jaw, with the large protocone forming the inner tip, widely separated from the outer cone (apparently the paracone), which, with parastyle and metastyle, appear to be the only cusps developed. In the lower jaw, the three last premolars are of about equal size, the first of them (p_2) with a minute cusp about half-way up on its posterior edge, the second (p_3) with two such cusps, and the last (p_4) with but one, which, however, is much larger than in the two other teeth. The three anterior cusps of the first lower molar are prominent, with blade-like edges set in a triangle, succeeded by a low, basin-like heel with three low cusps at its edges, one posterior, and one each on the inner and outer rim close to the back. The second lower molar is slightly less than the heel of the first, with two pairs of low but well-marked cusps. The tooth formula is, therefore, usually: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{2}{2}$ = 40, with occasionally an extra one or two molars above or below, on which a few notes are given beyond.

Although various specific names have been bestowed upon civets from eastern China, these seem all to be based upon slight peculiarities of color pattern. A large series, such as that now available for study, shows that but a single form occurs over the southern parts of China, nearly identical with the Indian animal, which is the type species of the genus. Possibly the "beautiful viverra," recorded from Kwangsi by Shih (1930, p. 5) as *Prionodon pardicolor*, is this species, for the latter is not definitely known to occur in China.

194. **Viverra zibetha ashtoni** Swinhoe

CHINESE CIVET

Viverra ashtoni Swinhoe, Proc. Zool. Soc. London, 1864, p. 379, fig.

Viverra zibetha Linnæus, Syst. Nat., ed. 10, vol. 1, p. 44, 1758. G. M. Allen, Amer. Mus. Novitates, no. 359, p. 1, 1929 (in part).

Viverra sp. aff. *undulata* Hilzheimer, Abh. u. Ber. Mus. f. Natur- u. Heimatk., Madgeburg, vol. 1, p. 175, 1906.

Viverra filchneri Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 192, 1908.

Viverra zibetha filchneri Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 7, 1922. A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 30, 1929.

Viverra zibetha ashtoni A. B. Howell, *loc. cit.* Pocock, Journ. Bombay Nat. Hist. Soc., vol. 36, p. 427, 1933.

Type specimen:—Swinhoe's type of *Viverra ashtoni* came from Suykaou, the Min River, Fukien, China, but apparently is not preserved. Pocock writes (1933) that it is not in the British Museum, although other specimens of Swinhoe's collecting are preserved there.

Description:—The usual color consists of a grizzled gray and blackish ground color from the muzzle and cheeks, back to the root of the tail, the sides of the body washed more or less with buffy toward the posterior half, and marked by about five irregular and more or less indistinct wavy transverse bands of blackish, whose lower ends show as more pronounced blackish-brown marks on the sides of the belly. The haunches show a number of ill-defined dark markings that tend to arrange themselves in lengthwise stripes, three or four in number. A black stripe commences at the lower part of the neck in the mid-dorsal line and extends to the root of the tail, becoming wider and of longer erectile hairs on the lower back, and ending abruptly with the first black ring at the base of the tail; it is bordered on the back by a white stripe on each side. Fore and hind feet chocolate brown. Chin and throat blackish brown, interrupted by three transverse white bands, originating from behind and below the ear, the first forming a narrow anterior ring, the second much wider and separated from the first by an intervening narrow area of blackish; the third white ring passes first directly back to the lower part of the throat, then becomes transverse, cutting off a wide blackish patch in front of it, and having a black stripe bounding its upper and posterior borders. The ventral surface of the body is whitish, due to the long white-tipped guard hairs, beneath which the fur is pale brownish basally, with a scattering of longer brownish hairs. The tail is full, bushy and tapering, with a white transverse ring at its base, across which the mid-dorsal black stripe extends to the succeeding ring, which is black, with the middle portion ochraceous on each side of the middle line. Following this are five more white rings alternating with five black ones, the basal one or two of the latter sometimes showing a small amount of ochraceous laterally, or an incomplete mid-dorsal black line connecting the first and second black rings.

In all these characters there is a considerable range of purely individual variation. In skins from the same locality, the buffy ground color of the body may be replaced by clear gray, due to a mixture of white-tipped and blackish hairs. The pattern on the flanks may be extremely indistinct, with every gradation from well-marked stripes to inobvious spots and blotches or indis-

A live Civet (*Viverra zibetha ashtoni*). Yunnan. Note the dorsal crest of erect hair

Head of a Civet (*Viverra zibetha ashtoni*). Mucheng, Yunnan

tinct cross-stripes that become well defined on the rump. The number of rings on the tail is usually twelve, six white and six black, the terminal one black, but there may be only five of each, while in one from Fukien there were no fewer than eight of each, the last three black ones very close together and separated by very narrow white rings. Usually only the basal black ring is connected dorsally with the dark body color by an extension of the median black stripe across the intervening white ring, but occasionally this may continue to the second or third, or even beyond as a few scattered black-tipped hairs in the median line of the white ring. In specimens having a well-developed buffy tint on the sides, it is usual to find the basal one or two black tail-rings provided with a pair of ochraceous centers separated by the median black stripe. In one exceptionally bright skin from Fukien, these centers are rusty in color and are indicated even on the third black ring as scattered hairs of that hue.

In the skull there is an increasing narrowness of the distance across the supraorbital processes with age, and correlated with this, an increasing narrowness of the constriction behind them, so that in a skull in which the temporal ridges just meet, the first distance is 32.5 mm. and the postorbital constriction 25.2, whereas in an older skull with well-developed sagittal crest, these distances are 26 and 17.1 mm. respectively. There is more or less variation in the outline of the posterior border of the palate, which may be evenly arched, or bracket-shaped, or again with simply a short median spine. In the teeth there is a tendency to develop a third molar in upper and lower jaw, as well as a considerable amount of variation within narrow limits, in the crown area of the molars. Three adult skulls from Wanhsien, Szechwan, show the third molars, as follows: No. 57054 has a well-developed upper third molar on the right side, situated on the outer border of the tooth row, and with its crown turned backward at an angle of about 45 degrees. It abuts against the posterior outer root of m^2, and has about one-fourth its crown area, is nearly circular in outline, about 3 mm. in diameter, unworn, with two minute external cusps and an inner one. On the left side of the palate is the alveolus of a similar tooth, lost probably in cleaning. No. 57052 has a third molar on the right-hand side, some 4.5 mm. in diameter, and about one-quarter the size of the second molar. Its crown is turned similarly, so that its long axis is at about 45 degrees to the line of the tooth row. On the right side there is a much larger third molar, showing an abnormal condition of growth as if more than one tooth were agglutinated and grown out of shape so as partly to overlie the crown of m^2. The specimen is further peculiar in having a third molar on each side in the lower jaw, but in each case situated not behind but *beside* the second molar and crowded to the outer side. In size these extra molars are the smallest. In the third specimen, an old male, No. 58379,

with well-worn molars, there is a small circular alveolus about 1.5 mm. in diameter on the right side, where evidently there was a third upper molar that has been lost in cleaning; on the left side in the corresponding position, there is a partly filled alveolus where the third molar once stood, but it had evidently been shed and the cavity nearly closed.

Measurements:—The following dimensions were taken from the fresh specimens in the field.

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
58380	670	375	125	57	♀	Szechwan
58381	830	460	135	58	♀	Szechwan
58379	770	400	130	60	♂	Szechwan
84415	800	437	125	56	♀	Fukien

CRANIAL MEASUREMENTS OF *VIVERRA ZIBETHA ASHTONI*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth $c\text{-}m^2$	Lower cheek teeth $c\text{-}m_2$	Sex	Locality
57056	139.0	133.0	71.0	68.0	41.5	43.5	57.8	64.0	♂	Szechwan
57054	135.3	127.5	71.0	67.6	46.0	43.6	55.0	61.0	♂	Szechwan
58379	140.0	133.0	73.0	68.2	45.0	43.7	57.2	63.8	♂	Szechwan
60140	143.0	133.5	73.3	69.0	46.0	43.0	56.0	62.0	♂	Fukien
60177	139.0	132.0	72.0	66.3	43.4	40.5	55.0	61.0	♂	Fukien
84410	——	——	72.5	66.0	——	41.5	55.8	62.0	♂	Fukien
84416	141.0	132.0	72.7	68.3	43.0	42.5	55.5	61.5	♂	Fukien
Average	139.5	131.8	72.2	67.7	44.0	42.6	56.0	62.1		
45512	137.5	130.0	71.4	63.0	41.5	41.5	55.0	62.0	♀	Fukien
57055	136.5	128.0	69.0	68.5	42.5	43.5	54.0	60.0	♀	Szechwan
58381	141.0	134.0	73.0	69.0	44.5	42.0	53.7	61.0	♀	Szechwan
59316	140.0	132.0	74.5	65.4	42.2	39.7	55.2	61.0	♀	Fukien
60141	140.0	133.0	67.0	67.0	43.5	40.5	54.5	61.0	♀	Fukien
60178	139.0	129.0	69.0	68.0	42.5	40.5	53.4	59.0	♀	Fukien
60179	135.0	128.0	69.0	63.4	42.2	38.5	54.0	60.5	♀	Fukien
84343	134.5	128.0	71.0	68.0	43.5	42.7	55.0	61.0	♀	Szechwan
84344	141.0	133.0	73.2	69.0	44.5	41.8	55.0	61.6	♀	Szechwan
84414	142.5	134.8	75.2	66.8	44.0	39.2	57.0	63.0	♀	Szechwan
Average	138.7	130.8	71.2	66.8	43.0	40.9	54.6	61.0		
60094	130.0	118.3	63.3	62.8	40.5	39.8	50.0	57.1	♀	Hainan

It will be seen from these figures that, on the average, males and females show very little disparity in size. The skulls of the females average a very little smaller, but the amount is negligible. A skull from Hainan seems smaller than usual.

Nomenclature:—With a magnificent series of over fifty skins for examination, it becomes evident that there is considerable variation in the details

of the color pattern of this species, that is purely individual. In 1864, Swinhoe named a Civet from the Min River, Fukien, *Viverra ashtoni*, pointing out that it differed from the typical race in having no obvious cross-bands on the haunches, and with the black dorsal stripe continued to the third dark tail-ring, instead of ending with the first. In the present series from Fukien, however, it is clear that these characters are not constant. A. B. Howell (1929) regards *ashtoni* as a subspecies of *V. zibetha* but admits that the single specimen he had does not agree very well with either Swinhoe's original description or his figure. Pocock (1933), however, says that the Indian Civet is shorter-haired, and so regards it as a valid race. Matschie's *V. filchneri*, based on trade skins purchased at Hinganfu, southeastern Shensi, is a synonym. The characters claimed as distinctive of this species are: the presence of wavy cross-bands on the haunches, six instead of five broader black and six narrower white tail-rings, of which only the basal dark ring is connected with the black dorsal stripe, the black tail-tip, a broadening of the middle dark throat-band, and the smoke-gray under fur, characters all of which are subject to a certain amount of individual variation, as the examination of a sufficient series shows. Wroughton, in 1915, gave subspecific names to two supposed Indian races: *V. z. picta* from the Upper Chindwin River, Burma, and *V. z. pruinosa* from the Little Tenasserim River, Burma. He later concluded that the former is untenable but distinguished the latter race by its clear gray ground color without a yellow tinge. Both these variations occur, however, in Chinese specimens from a single locality. Robinson and Kloss have since (Rec. Indian Mus., vol. 19, pt. 4, p. 176, 1920) added another supposed race, *V. z. sigillata*, from peninsular Siam, characterized by the sharper definition of its markings. All these characters seem unimportant and subject to much individual diversity. It is possible that the Hainan animal is smaller, however, as indicated by the smaller size of the only available skull from that island.

Occurrence and Habits:—The Civet is apparently not uncommon over most of the southern half of China, from the Yangtze basin southward, but avoids the high country of western China. On the coast, the most northerly record I have is of a skin and skull obtained by the American Museum Asiatic Expeditions at Chingkiang, Kiangsu, and it occurs also in the neighborhood of Shanghai, and in the Chusan Islands. To the westward, it may occur as far as the extreme southern borders of Shensi, Thomas (1911d) having recorded a native skin obtained forty miles north of Hanchungfu; trade skins were obtained also at Hinganfu, southeastern Shensi, by the Filchner Expedition, but the exact origin of such specimens is not easy to trace, and often they are sent from a long distance. To the southward, Jacobi (1922) mentions two skins from near Ichang, Hupeh, one of which was grayer, the other more yellowish; the American Museum's collections include specimens from eastern

FIG. 18. Distribution Map.
Viverra
V. zibetha ashtoni

Szechwan, as from Wanhsien and Tsomalin, and A. B. Howell (1929) mentions others in the U. S. National Museum from Wachin and Yachowfu, in the same province. Avoiding the Szechwan highlands, however, the Civet ranges southward into southwestern Yunnan, whence skins have been seen from Likiang and the Namting River. Others are from Hupeh (Fonghsien) and Hunan (Yochow). Swinhoe (1870c, p. 630) wrote that it is common in the bamboo-covered hills of southeastern China from near Shanghai to Canton, and Mell (1922) states that it is found all over Kwangtung, though commoner in the less populous northern parts. It is found also on Hainan, where, however, it seems less numerous. Swinhoe (1870a, p. 227) procured two flat skins there and J. A. Allen (1906) mentions a female specimen secured there.

Little is recorded of the habits of the civet in China. It is chiefly carnivorous, but likes a certain amount of fruit also. Mell (1922) notes that the stomachs of two that he secured in Kwangtung contained snakes and crabs, while in a third were snakes, insects, remains of a ?*Julus*, and fruit. Shih (1930) states that the flesh is "delicious."

Specimens examined:—Fifty-five, as follows:

Kiangsu: Chingkiang, 1.
Fukien: Futsing, 25; Yenping, 8.
Hupeh: Fonghsien, 1.
Hainan: Namfong, 1.
Szechwan: Wanhsien, 12; Tsomalin, 1.
Yunnan: Likiang, 2; Namting River, 4.

Genus **Viverricula** Hodgson

THE LESSER CIVET

Viverricula Hodgson, Ann. Nat. Hist., vol. 1, p. 152, 1838.

This smaller civet occurs with its larger relative, the Chinese Civet (*Viverra*), over the subtropical and tropical parts of the East. Formerly included as a subgenus of *Viverra* by most writers, it is at present accorded full generic rank. The group differs in its smaller size and color pattern, the lack of an erectile dorsal crest, and in many details of the skull and teeth, the most outstanding of which are the narrowed and laterally compressed form of the skull, and the much more enlarged audital bullæ, that project well beyond the paroccipital processes and have their anterior as well as the posterior chamber enlarged. The teeth are relatively sharper in their cusps, the second molar more reduced. The teeth are the same in number as in normal specimens of *Viverra*, namely: i.$\frac{3}{3}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{2}{2}$ =40. While the genus is not very strikingly different from the latter, its general characters seem important enough to establish its coördinate rank. There is but a single eastern species, although Bonhote, who revised the genus in 1898, accorded full specific rank to the Chinese representative. There can, however, be no doubt that with a better series of specimens at command, from intermediate localities, he would have admitted the subordinate relationship of the latter. No type species seems to have been formally designated. As originally proposed the genus contained two, *Viverra indica* Geoffroy, which is a synonym of *Viverricula malaccensis*, and *Viverra rape*. The former may, therefore, be taken as the genotype.

195. **Viverricula malaccensis malaccensis** (Gmelin)

THE RASSE OR LESSER CIVET

Viverra malaccensis Gmelin, Linnæus's Syst. Nat., ed. 13, vol. 1, pt. 1, p. 92, 1788.
Viverricula malaccensis malaccensis G. M. Allen, Amer. Mus. Novitates, no. 359, p. 3, 1929.

Type specimen:—Not known to exist. The type locality is Malacca.

Description:—A medium-sized civet, about as large as a small house cat, the tail about two-thirds the length of head and body. The general ground color of the body is a grizzled gray and blackish, with a dark blackish stripe

extending along the side of the neck from the posterior base of the ear, and from five to eight narrow dark stripes on the middle area of the back, that become broken into lines of spots on the sides. Feet and a small crescentic mark at the anterior corner of the eye, dark brown. Tail with from six to nine dark rings alternating with white or buffy-tinted rings. Of twenty skins from Hainan, all but one are gray in the color of the body, the exception having a buffy cast.

The skull is in general a miniature of that of *Viverra*, but differs in a number of details. Its general form is much more compressed from side to side and relatively higher, with a depth above the audital bulla equal to the length of the maxillary tooth row instead of much shorter. The postorbital constriction is greater, and the sagittal crest at the occiput much higher in proportion. The audital bullæ are so much more inflated than in *Viverra* that they project conspicuously below the paroccipital processes, whereas in the latter genus they are considerably lower than these processes. Their anterior chamber is distinctly inflated, but not in *Viverra*, and the entire bulla is relatively larger. The teeth agree in number and general form in the two genera, but the cusps in *Viverricula* are somewhat higher and more trenchant, as in the last lower premolar whose posterior cusp is larger in proportion and more compressed. The upper first molar differs in the outline of the crown in having the inner portion more sharply triangular, lacking the rounded shelf-like cingulum bounding the base of the protocone in *Viverra*.

Measurements:—No measurements taken in the flesh by the collector are available.

CRANIAL MEASUREMENTS OF *VIVERRICULA MALACCENSIS MALACCENSIS*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Mas-toid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Length of bulla	Sex	Locality
59947	95.7	91.2	49.0	46.0	30.0	28.4	38.0	41.3	20.8	♂	Hainan
59951	96.7	93.0	50.0	48.0	31.8	29.0	37.2	41.2	22.0	♂	Hainan
59952	97.3	94.0	48.5	47.0	30.6	28.7	37.2	41.5	21.0	♂	Hainan
59954	96.5	92.2	50.0	47.8	33.2	27.0	37.6	41.7	20.8	♂	Hainan
60073	92.0	88.5	47.0	46.2	28.7	27.4	37.0	41.6	20.0	♂	Hainan
Average	95.6	91.8	48.9	47.0	30.8	28.1	37.4	41.4	20.9		
59946	94.0	90.0	47.0	44.0	29.0	28.3	37.3	40.8	20.4	♀	Hainan
59949	93.5	90.0	48.0	46.5	31.0	27.2	35.7	40.0	20.6	♀	Hainan
59953	96.3	92.5	47.8	44.0	29.6	27.2	37.0	41.0	21.0	♀	Hainan
59955	95.3	91.6	50.2	45.5	32.7	29.5	38.4	42.6	20.5	♀	Hainan
59956	93.0	89.3	46.3	44.5	30.0	27.8	36.0	39.4	20.5	♀	Hainan
Average	94.4	90.8	47.8	44.9	30.4	28.0	36.8	40.7	20.6		

These figures, taken from adult or old skulls, indicate but very little difference in size between males and females.

Occurrence and Habits:—The type locality of the Lesser Indian Civet is Malacca, and, although several subspecies have been named, Wroughton, writing in 1918, states that he has entirely failed in finding one that seems valid. The series from Hainan agrees in skull measurements with those published for the typical form, so that it is here considered the same. The general range probably includes the entire Malay Peninsula to the southern border of China and Hainan, and Thomas has lately identified specimens taken by the Delacour expeditions in Indo-China as the same. Over most of South China, the following race occurs, doubtless intergrading with the true *malaccensis* along the Chinese boundary.

Mr. Clifford H. Pope, who secured the Hainan series, writes of his observations on its habits there, that it is very common all about Nodoa, and, according to his Chinese hunter, does not climb trees. A young one being reared by friends at the Mission remained very wild, even after several weeks, though it could be handled and did not bite. If loosed in a room, it immediately sought the shelter of the darkest corner. When alarmed it made three distinct sounds, a cat-like growl, a plaintive cat-like noise, and a peculiar chuckle, the three sounds sometimes given in succession. Its food was bananas and other fruit.

Specimens examined:—Twenty-two, namely:
Hainan: Namfong, 2; Nodoa, 20.

196. **Viverricula malaccensis pallida** (Gray)

CHINESE LESSER CIVET

Viverra pallida Gray, Proc. Zool. Soc. London, 1832, p. 63; Illustrations of Indian Zool., vol. 2, pl. 6, 1834.
Viverricula pallida Bonhote, Ann. Mag. Nat. Hist., ser. 7, vol. 1, p. 121, 1898.
Viverricula hanensis Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 196, 1908.
Viverricula malaccensis pallida G. M. Allen, Amer. Mus. Novitates, no. 359, p. 3, 1929.

Type specimen:—The type of this race was sent to the British Museum by John Reeves, probably from the vicinity of Canton, Kwangtung, China. The specimen was figured by J. E. Gray in his "Illustrations of Indian Zoölogy" under the name *Viverra pallida*, and, although the name appeared two years earlier in the Proceedings of the Zoölogical Society of London, it was unaccompanied by description, so that the basis of the name is really Gray's plate.

Description:—Similar to the typical race but slightly larger, more rufous in coloration and longer-haired in winter coat, with less obvious stripes. The usual ground color of the hair is ochraceous buff, individual hairs having a pale base, a subterminal ring of ochraceous and a black tip. The color pattern is more obscure in winter when the pelage is fuller. The under fur

is pale smoky in color. The number of rings on the tail, which has been used as a character of systematic importance, varies within narrow limits, from occasionally as few as six to rarely as many as nine or ten. In rare cases, too, the ground color may be gray instead of ochraceous.

Measurements:—The following measurements were taken by the collectors in the field:

No.	Head and body	Tail	Hind foot	Ear	Sex	Locality
43128	530	350	97	42	♂	Yunnan
58373	556	312	100	40	♂	Szechwan
58377	570	320	105	43	♂	Szechwan
84433	550	305	96	43	♂	Fukien
84351	480	295	90	40	♂	Szechwan
58374	525	325	94	40	♀	Szechwan
84348	460	250	83	40	♀	Szechwan

CRANIAL MEASUREMENTS OF *VIVERRICULA MALACCENSIS PALLIDA*

No.	Condylo-basal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Length of bulla	Sex	Locality
43128	93.6	89.0	46.0	44.0	30.2	27.5	35.5	40.2	22.8	♂	Yunnan
58373	96.0	92.0	48.7	44.0	31.0	28.0	38.0	42.5	21.5	♂	Szechwan
59319	100.0	95.4	52.5	47.1	32.3	30.3	40.2	44.5	22.1	♂	Fukien
60125	103.5	98.5	52.5	47.0	31.0	31.0	40.5	44.8	22.0	♂	Fukien
60136	102.3	97.5	55.6	46.7	32.0	29.8	41.0	45.2	22.0	♂	Fukien
60180	100.5	97.0	53.4	51.5	32.0	30.3	39.5	42.5	21.0	♂	Fukien
84422	101.3	97.5	53.8	45.5	30.0	28.3	39.0	46.0	22.0	♂	Fukien
84431	101.0	97.0	54.0	50.0	31.2	28.8	39.0	42.6	21.0	♂	Fukien
84430	105.0	100.3	54.5	50.5	33.0	31.0	41.5	45.5	22.3	♂	Fukien
84421	105.0	101.0	54.5	48.0	31.6	29.3	40.5	45.7	22.3	♂	Fukien
Average	100.8	97.5	52.5	47.4	31.4	29.5	39.4	43.9	21.9		
43125	96.3	92.0	49.0	45.5	31.8	——	34.8	39.0	21.9	♀	Yunnan
45506	95.4	91.5	49.2	46.0	31.0	29.8	37.5	40.6	22.3	♀	Fukien
45507	96.0	92.0	49.0	44.8	31.0	29.0	37.3	40.4	21.8	♀	Fukien
45515	99.3	95.2	53.3	49.6	32.0	31.0	38.7	43.0	22.1	♀	Fukien
60135	101.0	96.3	52.4	47.0	32.0	30.2	39.6	43.3	21.0	♀	Fukien
59321	102.5	98.2	54.3	48.7	33.8	29.3	38.8	43.5	22.5	♀	Fukien
84347	100.5	96.4	52.2	47.5	32.3	29.7	38.7	43.7	22.5	♀	Szechwan
84427	102.3	98.0	52.2	48.8	31.6	29.3	39.0	43.2	21.0	♀	Fukien
58374	95.2	91.0	47.0	44.5	31.2	28.3	36.0	40.0	22.0	♀	Szechwan
Average	101.1	94.5	50.9	46.9	31.8	29.5	37.8	41.8	21.9		

Nomenclature:—This is perhaps little more than a barely recognizable race, differing in larger size and slightly more buffy color from the southern animal. Matschie's *Viverricula hanensis* was based on a skin obtained by Kreyenberg in the fur market at Hankow, and is said to lack cross-bands on the shoulders, while the tail has eight dark rings, of a width not less than that

of the light ones. These differences, however, are purely individual, and there seems at present no reason for supposing that more than one race, *Viverricula malaccensis pallida*, occurs over South China.

Occurrence and Habits:—It is interesting that the range of this animal in China is almost exactly co-extensive with that of the large Civet, *Viverra zibetha*, extending from the Yangtze basin southward, and in the west reaching the base of the Szechwan highlands and central Yunnan. The most northerly record I have is of a specimen in the Museum of Comparative Zoölogy, from Tunglu, Chekiang, near the mouth of the Yangtze, secured by J. T. Wright. The Museum also has a specimen from Ichang, Hupeh, whence the Weigold Expedition obtained one as well (Jacobi, 1922). The Central Asiatic Expeditions secured several from Wanhsien, in eastern Szechwan, and A. B. Howell records one in the U. S. National Museum from Suifu in the same province. The field work of these expeditions resulted in the accumulation of a good series from Futsing and Yenping, Fukien, and others from Yochow, Hunan Province, Likiang, Yunnanfu, and the Namting River, Yunnan Province. Mell (1922), writing of the Canton region, says it is the commonest civet next to the Masked Civet. At Siudsau, Kwangtung, two nurslings with the mother were brought to him that were taken in early July. Mr. Clifford H. Pope, who collected with such success in Fukien, writes me that this species is abundant in the vicinity of Futsing and is frequently driven from thickets or other cover in the fields or along the base of the more open mountains by dogs. He did not see it, however, during his stay in Kuatun, in the northwestern corner of the province. The Chinese call it "pi mao" or Pen Cat, because the hair of the tail is utilized in making brushes or "pens." According to Shih, the flesh is also regarded with favor by the natives.

It is interesting that the milk dentition consists of fairly serviceable teeth, and that these are retained for a relatively long time, so that individuals of nearly full size, with skull having a condylobasal length of from 88-92 mm., still retain the full milk dentition with no sign of the permanent teeth coming through. The upper canines of this set are long and bowed forward, almost sickle-shaped. In an aged skull (No. 84431), the small second molar of the upper jaw has been lost from both sides, the alveolus in each case more or less closed over.

Specimens examined:—In all, sixty-three, as follows:

Kiangsu: Nanking, 1 (Univ. Mich.).
Chekiang: Tunglu, 1 (M.C.Z.).
Fukien: Futsing, 41; Yenping, 3.
Hunan: Yochow, 1.
Hupeh: Ichang, 1 (M.C.Z.).
Szechwan: Wanhsien, 10.
Yunnan: Likiang, 1; Namting River, 2; Yuankiang, 1; Yunnanfu, 1.

Genus **Paradoxurus** F. Cuvier

THE PALM CIVETS

Paradoxurus F. Cuvier, in Geoffroy and Cuvier, Hist. Nat. des Mammifères, vol. 2, pt. 24, pl. and 5 pp. text, 1821.

Quite in contrast to the Civets, the Palm Civets or "Toddy Cats," are markedly arboreal in their habits, in accordance with which their tails are longer in proportion, and though not strictly prehensile, are capable of being slightly coiled and providing efficient aid in climbing. The palms and soles of the feet have their naked pads slightly roughened and practically continuous with the toe-pads, instead of being separated by an intervening hairy area. The claws are retractile as in cats. The skull in a general way resembles that of a *Viverricula*, but is somewhat larger, lacking the high narrow occipital crest. The audital bullæ are very little inflated, and do not extend below the level of the broad, triangular paroccipital processes against which they closely abut; the basioccipital has a prominent median ridge. In striking contrast is the much more rounded condition of the cusps of the posterior teeth, in keeping doubtless with the more frugivorous habits. The anterior premolars are actually smaller in the larger *P. hermaphroditus* than in *Viverricula*. The third upper premolar differs in having a low internal buttress, instead of a more compressed blade-like structure; the fourth premolar of the upper jaw has a large antero-internal cusp, bluntly rounded, and a very small antero-external one. The first upper molar is not triangular in outline, but has the inner part broad instead of pointed, with a well-developed hypocone, so that the lingual border is nearly parallel to the labial. All its cusps are low and bluntly rounded. The second molar is much smaller, but of broadly rounded, somewhat oval outline, with two very small outer cusps (paracone and metacone) and a low inner cone at the extreme inner edge. In the lower jaw, the last premolar, though small, has a broad, basin-like heel, and cusps that closely resemble in their arrangement those of the first molar, a much larger tooth. The second molar is relatively larger than in *Viverricula*, about the size of the fourth lower premolar, and with low, blunt cusps much resembling it. The genotype is *Paradoxurus typus* of India.

The Palm Civets are more strictly tropical in their distribution, extending over India and the Malayan region to the East Indies, and barely reach the southern or southeastern borders of China. Two species occur, a larger one in Hainan, and a smaller that has apparently been once secured in southeastern China.

Key to Chinese Species of *Paradoxurus*

A. Size larger, skull length more than 100 mm..... *P. hermaphroditus laotum*
B. Size smaller, skull length less than 100 mm..... *P. minor exitus*

197. **Paradoxurus hermaphroditus laotum** Gyldenstolpe

THE PALM CIVET

Paradoxurus hermaphroditus laotum Gyldenstolpe, Kungl. Svensk. Vet.-Akad. Handlingar, Stockholm, vol. 57, no. 2, p. 26, 1917.
Paradoxurus hermaphroditus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 240, 1909.

Type specimen:—An adult male, skin and skull, from Chieng Hai, upper Siam, collected by Count Gyldenstolpe's expedition, August 15, 1914. The specimen is presumably in the Riks-museum at Stockholm, Sweden.

Description:—Ground color of the neck and body varying from a pale grayish buff to nearly golden, with a pair of narrow black stripes running from the occiput to the tail parallel to a median black stripe from shoulders to tail. Below these are a number of blackish spots arranged in indistinct lengthwise lines along the flanks, and in cross-rows on the haunches. The head and throat back to the occiput and including the ears, are black, merging into the grayer tint of the back. Below the eye is a short, lengthwise mark of white; the forehead between the eyes is mixed with gray, and with white above the eyes; the outer base of the ears is also white. The feet are blackish brown, the tail black terminally, its base colored like the back, with a median black line continuous with that of the back. Belly grayish buff without spots. In one specimen, the entire throat to the upper chest and the sides and crown of the head are shining black, but in most specimens these areas are much mixed with paler hairs.

The chief characters of the skull have already been mentioned. The uninflated bullæ, the lack of a high posterior sagittal crest, and the blunt, rounded cusps of the molar teeth are most striking.

Measurements:—No flesh measurements of Chinese specimens are available. In general, however, this species is about the size of a house cat.

CRANIAL MEASUREMENTS OF *PARADOXURUS HERMAPHRODITUS LAOTUM*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Length of bulla	Sex	Locality
59992	107.0	99.5	50.0	56.0	36.5	32.7	40.0	44.8	20.2	♂	Hainan
59993	114.7	106.8	56.1	63.0	38.3	35.8	43.8	47.2	20.2	♂	Hainan
59995	110.5	103.5	50.5	62.0	38.0	34.2	41.1	46.3	19.8	♂	Hainan
59991	105.6	99.2	51.0	51.5	34.7	33.2	42.8	47.6	20.0	♀	Hainan
59994	104.0	98.0	47.5	53.8	34.0	30.4	40.0	43.2	18.7	♀	Hainan
59996	103.8	96.2	46.7	52.5	35.8	32.0	38.0	42.3	18.0	♀	Hainan

There is seen to be very little difference in size between the sexes, though the females are slightly the smaller.

Nomenclature:—The typical *P. hermaphroditus* is considered as restricted to the mainland of the southern portion of the Malay Peninsula. Farther

north, in southern Siam, a slightly paler race, *P. h. ravus* Miller, has been described. More recently, Wroughton described *P. birmanicus* from near Sagaing, Upper Burma, a form to which probably the Chinese animal should be referred, were it not that Gyldenstolpe had described, about a month earlier, *P. h. laotum*, from upper Siam, and shown that these two are the same. Since his description seems to apply well to the Hainan Palm Civet, I have provisionally used his name for the Hainan animal, although it must be recalled that color characters in this group are subject to much individual variation, and a final review with adequate material might show that the supposed races are fewer than at present believed.

Occurrence and Habits:—The only part of China in which this Palm Civet is known to occur is the island of Hainan, whence Dr. J. A. Allen was the first (1909) to record it, a female, half grown, from Mount Wuchih, November 18, 1905. Later, in 1923, Mr. Clifford H. Pope succeeded in obtaining nearly a dozen at Namfong and Nodoa. Here it was said by the native hunters to be fairly common in the larger patches of jungle and heavy woods, living in the trees, and occasionally found on the ground as well. Their dispositions seemed rather savage, for when brought in alive in long baskets by the hunters, they would spit or seize upon anything put in. Two young "kittens" were kept alive for two or three weeks. At first they would spit in a most unfriendly manner but soon became very docile. They enjoyed climbing all over one and seemed to receive impressions mostly through the nose, whose long delicate tip was in constant motion and carefully extended toward every new object. They were fed on bananas and other fruit. Curiously, Swinhoe in 1870 makes no mention of this as a species of Hainan.

Specimens examined:—Ten, as follows:

Hainan: Namfong, 3; Nodoa, 7.

198. **Paradoxurus minor exitus** Schwarz

LESSER PALM CIVET

Paradoxurus exitus Schwarz, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 636, 1911.

Type specimen:—The type is an old female, skeleton only, from Fumui, east of Canton, Kwangtung, China. It is in the Zoölogical Museum at Berlin, original number 17.

Description:—The external characters of this species are unknown, but if my assumption that it is merely a northern race of *P. minor* of Jalor, Malay Peninsula, be true, the coloring is doubtless much as in that animal, as described by Bonhote (1903a, p. 9), viz., "color above, pale fulvous, showing on the back five longitudinal black stripes, of which the two outer ones tend to

break up into spots. These stripes converge anteriorly to form one broad black stripe, which arises from the crown of the head, slightly anterior to the ears. Across the forehead the hairs have white tips, giving it a grizzled appearance, while the muzzle, limbs, and under part of the throat are very dark brown. There is a small white crescent below, and slightly anterior to the eye, and a few irregular white spots on the chin. The remainder of the under parts are of a dull brownish-grey, while the flanks show a few irregular black spots. The tail is black throughout its length, with the exception of the terminal three or four inches which are of a dirty white."

The skull, on which the description of *P. exitus* is really founded (Schwarz, 1911, p. 636), is said to be characterized by the "brain-case becoming narrower anteriorly, and gradually passing into the intertemporal constriction, which is not sharply set off. . . . Bullæ short, rounded in front, and strongly inflated between carotic canal and *foramen lacerum posterius* . . . $P_4[p^4]$ with the paracone reduced as in *cochinensis*, but with much shorter metacone and better developed postero-internal ledge."

Measurements:—The type skull and only known specimen is said to show the following measurements: basilar length, 84 mm.; palatilar length, 43; zygomatic width, 55; width of brain case at squamosal, 34; mastoid width, 33.6; intertemporal constriction, 12.5; upper cheek teeth, 35; length of pm^4, 7.5; its greatest oblique diameter, 9.

Nomenclature:—The measurements given by Schwarz for the type skull of *P. exitus* seem to coincide very closely with those given for the skull of *P. minor* by Bonhote, so that there seems very little doubt that the Chinese animal represents the same species, or at most a local northeastern race of it. In the latter event proving true, the name will stand as I have given it above.

Occurrence and Habits:—The description of this Palm Civet, from Fumui, east of Canton, in southeastern Kwangtung, constituted the first record of the genus for the mainland of China. No further specimens are known, but its occurrence should be expected sparingly along the extreme southern borders.

Specimens examined:—None.

Genus **Paguma** Gray

THE MASKED CIVETS

Paguma Gray, Proc. Zool. Soc. London, 1830, p. 95, published Aug. 5, 1831; Zoological Miscellany, no. 1, p. 17, 1831.

The Masked Civets represent a slightly more specialized condition than the Palm Civets, with a loss of the striped pattern on the back, although this appears faintly in the young. The skull has a shorter, broader rostrum, and

FIG. 19. Distribution Map.
Paguma

1. *P. larvata larvata*
2. *P. larvata intrudens*
3. *P. larvata hainana*

there is no deep constriction behind the postorbital processes, but instead the forehead maintains its width from the center of the orbits to the anterior border of the parietal bones, with the postorbital processes barely projecting. The teeth are the same in number as in *Paradoxurus*, but are more modified for crushing. The upper carnassial has a lower, shorter crown, and its cusps are broad, and bluntly rounded, with the antero-internal cusp equaling the antero-external one instead of being much larger. In side view the central cusp alone projects, the posterior heel being flat and shelf-like, instead of trenchant with a sharp edge as in *Paradoxurus*. The upper first molar has but three cusps, of which the two outer are subequal, low, and bluntly rounded, the internal cusp even lower, but similarly blunt. The first lower molar has the usual five cusps, but all are very low and rounded, and the tooth is broader than in the latter genus. Frequently the second molar of the upper jaw or of both jaws shows a tendency to be wanting, perhaps another progressive trait in these animals. The upper canines also are slightly more modified,

being longer, and wider in side view, more evidently compressed from side to side, with a faint rib-like column in the center of the inner face.

The genus occurs from Nepal across China to Formosa, and south into the larger islands of the East Indies. The Chinese species is the genotype and longest known, and is represented in southern China by apparently two geographical races on the mainland and one in Hainan, all closely related.

199. **Paguma larvata larvata** (Hamilton Smith)

THE MASKED CIVET

Gulo larvatus Hamilton Smith, in Griffith, Animal Kingdom by Cuvier, vol. 2, p. 281, pl., 1827.
Paguma larvata Gray, Proc. Zool. Soc. London, 1831, p. 95. Swinhoe, Proc. Zool. Soc. London, 1870, p. 630. Thomas, Proc. Zool. Soc. London, 1911, p. 688.
Paradoxurus larvatus Trouessart, Cat. Mamm. Viv. Foss., p. 330, 1897. Hilzheimer, Abh. u. Ber. Mus. f. Natur- u. Heimatk., Magdeburg, vol. 1, p. 177, 1906.
Paguma reevesi Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 196, 1908.
Paguma larvata rivalis Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 8, p. 618, 1921.
Paguma larvata reevesi Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 8, 1922.
Paguma larvata larvata G. M. Allen, Amer. Mus. Novitates, no. 359, p. 4, 1929.

Type specimen:—The name was originally given to a mounted specimen in the Leiden Museum, which may be regarded as the actual type. Locality unknown.

Description:—About the size of a house cat but with shorter limbs. There are no stripes on the body or rings on the tail. Head and neck to the shoulders black; a white blaze on the forehead, sometimes extending back for a varying distance on to the occiput or neck as a narrow line of white-tipped hairs. A white mark below and another above the eye, extending to the base of the ear and below it, often forming a nearly complete half-collar. Upper parts and proximal portion of the tail grayish to ochraceous; terminal half of the tail and the feet blackish brown.

As in other civets, there is a wide range of individual variation. In a series of nineteen from Fukien, the average skin has the entire back pale ochraceous buff, fading into nearly clear gray on the sides and belly. The under fur is smoky. In other specimens the ochraceous tinge of the back becomes so reduced as to be either very faint or wanting altogether. At the opposite extreme are one or two in which the ochraceous tips of the body hairs are so intensified that they are as bright as in skins from Hainan. The black tip of the tail usually comprises about half the length of that member; in one skin, however, it includes only the last third, while in two others and in a third from Szechwan, the tail is entirely gray or gray tinged with pale ochraceous, lacking the black tip entirely. A specimen of this type is recorded by Jacobi from Kiating, Szechwan, and the same variation is mentioned in a specimen from "Wahsin," Szechwan, by A. B. Howell. The black tip may be

rather well defined, or it may be a dark stripe running nearly the whole length of the dorsal side of the tail. The amount of black in the subterminal portion of the longer hairs is also subject to much variation, while the white head-markings are hardly the same in details in any two specimens. Usually, however, the white frontal blaze is continued back between the ears, but in at least two of the Fukien series, it may be traced as a narrow line of white-tipped hairs nearly to the shoulders. In one example from eastern Szechwan, it is well developed as far back as the scapular region, thus approaching the condition found in *P. l. intrudens*. While, usually, more or less of the mustachial vibrissæ are white, in occasional skins all are black. The chin is black, the throat mixed grayish.

Measurements:—An adult female measured in the flesh: head and body, 440 mm.; tail, 370; hind foot, 80; ear, 47.

CRANIAL MEASUREMENTS OF *PAGUMA*

No.	Occiput to gnathion	Condylo-basal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
				P. larvata larvata							
43138	113.0	——	——	55.4	62.5	40.3	37.2	39.0	42.0	♂	Fukien
57049	115.0	113.5	106.8	55.5	64.0	41.0	38.2	39.5	43.2	♀	Fukien
57064	116.5	116.3	110.7	59.0	59.0	39.2	36.5	40.5	44.5	♀	Fukien
84407	110.5	108.0	103.3	56.0	64.2	39.0	37.3	37.2	40.8	♀	Fukien
84406	111.0	111.2	106.0	55.0	58.6	36.8	36.5	38.3	42.1	♂	Fukien
84408	113.0	109.5	104.0	55.0	61.0	38.5	37.0	37.5	41.8	—	Fukien
				P. larvata intrudens							
(type of *P. l. yunalis*)	——	——	——	57.0	61.8	43.8	39.9	40.7	45.9	—	Yunnan

Nomenclature:—The name *Gulo larvatus* was first published by Hamilton Smith, who took it from a specimen, so labeled by Temminck, in the Leiden Museum. This specimen, should it ever be reidentified, is, therefore, the actual type. Hamilton Smith's colored figure is a poorly executed sketch but gives a fair representation of the animal as we now know it from South China. The origin of the subject, however, is not recorded, but Temminck, who later, in his "Monographies de Mammalogie" (1841, vol. 2, p. 329, pl. 65, figs. 1, 2), described the animal as *Paradoxurus larvatus*, and figured the skull, stated that it had been obtained in London. Meanwhile Gray (Proc. Zool. Soc. London, 1831, p. 95; 1832, p. 67) had redescribed the species on the basis of a specimen sent from the vicinity of Canton by Reeves, referring it first to a new genus, *Paguma*, and then to *Paradoxurus*. Later he published a colored figure of the animal ("Illustrations of Indian Zoology," vol. 2, pl. 11, 1833-34), which, though in many respects crude, is again a fair representation. For

nearly three-quarters of a century the name stood, until Matschie in 1908 concluded that Hamilton Smith's crude figure more nearly resembled the Formosan race, named *taivana* by Swinhoe, and that, therefore, the type specimen must have come from Formosa. He therefore renamed the Chinese animal *Paguma reevesi*. Thomas (1909a), however, has shown that the Formosan civet does not resemble Hamilton Smith's figure nearly as well as do specimens from the lower Yangtze and that it is unlikely that in 1827 a palm civet would have reached London from Formosa. It seems best to follow Thomas in assuming that the original specimen was imported from South China, so that *P. reevesi* becomes a synonym of *P. l. larvata*. Thomas in a later paper (1921) named as a distinct race, *Paguma l. rivalis*, a pale skin from Ichang on the Yangtze, but there can be no doubt, from an examination of a series of skins from west-central China, that this name is also a synonym of *P. l. larvata*, and the western animal indistinguishable from that of the coast.

Occurrence and Habits:—The Masked Civet has a more extensive range northward than the Palm Civet, and in this respect more resembles the genera *Viverra* and *Viverricula*. The American Museum's splendid series includes a specimen from Tunglu, Chekiang, as the most northerly record, at the mouth of the Yangtze. To the southward it seems commoner, and was found by Mr. Clifford H. Pope to be of frequent occurrence in the vicinity of Futsing, Fukien. To the westward, Dr. Walter Granger secured several from the region about Wanhsien on the eastern border of Szechwan, and A. B. Howell has recorded others from Wahsin and Suifu in the same province, the only adult among them "quite pale" and doubtfully separate from *P. l. rivalis*, although entered under *P. l. yunalis*. Thomas (1911e, p. 688) records a male from southeastern Shensi, in the Shangchow district, the most northwesterly record yet available. In southern China it is generally distributed, and is the commonest civet in Kwangtung, according to Mell. Swinhoe (1870c) mentions its actively climbing habits, and tells of a tame one that would climb up doors as well as the legs of tables and chairs by putting one foot on each side and pushing up with the hind legs. It slept by day but was active most of the night. Dr. Walter Granger has published some notes on one that he kept as a pet, together with a photograph showing its method of holding on by means of the bent tail, closely applied. Mell (1922) found it in forest, bush, high woods or rocky places in Kwangtung. A large female with two nursing young perhaps eight or ten days old was brought to him on June 21, at Wutsung in that province. Pocock (1911a) records three young born in the London Zoological Gardens from a pair captured in Szechwan. Their eyes opened in about nine days, and their growth seemed very rapid in comparison with that of dogs or cats, so that in three months they equaled their parents in size. At first their color was quite different from that of their parents, grayer and less

yellow, with a pair of ill-defined dark stripes on the back and indistinct traces of a pattern on the sides of the body. In captivity they will eat fruits and cereals, and no doubt the former constitute a large part of the diet in a wild state. Mell (1922) notes that the stomach of one that he examined contained fruit, that of a second oranges, while two others had leaves in their stomachs. Swinhoe (1870c), on the other hand, wrote that his pet civet preferred cooked meat. On one occasion, a Masked Civet was pursued by a leopard into a native village, where it was killed with a stick (Mell, 1922).

According to Swinhoe, this civet is called by the Chinese the "Gem-faced Cat," on account of the white facial mark. Shih (1930) states that in Kwangtung it is called "mên-tsien-kiu."

Specimens examined:—In all, twenty-five, as follows:

Chekiang: Tunglu, 1.
Fukien: Futsing, 8; Yenping, 7; Chunganhsien, 1; no exact locality, 1.
Szechwan: Wanhsien, 5; no exact locality, 1.
Locality unknown, 1.

200. **Paguma larvata intrudens** Wroughton

WESTERN MASKED CIVET

Paguma larvata intrudens Wroughton, Journ. Bombay Nat. Hist. Soc., vol. 19, p. 793, 1910.
Paguma larvata yunalis Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 8, p. 617, 1921.

Type specimen:—The type is a skin and skull from Sima, near Myitkyina, in northeastern Burma, not far from the Yunnan border, No. 9.7.20.6 in the collection of the British Museum, an adult female.

Description:—Similar to *P. larvata larvata* but slightly larger, the back a brighter, deeper tone of ochraceous, the white mark on the forehead extended as a broad stripe to the shoulders, and the facial markings, including the whitish half-collar, more clearly defined.

Measurements:—No measurements of fresh specimens are available. This race, however, is supposed to be slightly larger than the typical form of eastern China. The only adult skull at hand seems to bear out this character. It is from Yuankiang, Yunnan, and measures: occiput to gnathion, 118.5 mm.; condylobasal length, 117.2; basal length, 112.5; palatal length, 58; zygomatic width, 66; mastoid width, 42.2; width across molars, 38.7; upper cheek teeth, 40; lower cheek teeth, 44.5.

Nomenclature:—There seems to be no doubt that Thomas's *Paguma larvata yunalis*, based on a skin from the Likiang Range, is indistinguishable. Wroughton considered the few available Yunnan specimens the same as his *P. l. intrudens*, but Thomas in 1921 gave the name *P. l. yunalis* to two skins

from Yenyuanhsien, southern Szechwan (not Yunnan as given in the original description), about two hundred and fifty miles east of Wroughton's type locality, on the ground that they were brighter in their ochraceous tint, with a very small suborbital white mark. The series of skins secured by the American Museum Asiatic Expeditions from Likiang and the Namting River, however, shows that the white suborbital mark is usually large and well defined instead of a "mere vague streak" as in Thomas's specimen, so that this as well as the difference in the ochraceous tint of the back are doubtless matters of purely individual variation.

Occurrence and Habits:—This rather poorly characterized race is found from southern Szechwan to northeastern Burma, and south through western Yunnan to central Tongking, whence Thomas has recorded it under the name *P. l. intrudens*. The American Museum Asiatic Expeditions secured a series of hunters' skins at Likiang, in Yunnan, and other specimens from the Namting River, and Tengyueh. The type of *P. l. yunalis* came from Yenyuanhsien, in southern Szechwan. Two specimens from 10,500 feet on the Likiang Range are recorded by A. B. Howell.

Specimens examined:—Nine, namely:

Yunnan: Likiang, 5; Namting River, 1; Tengyueh, 2; Yuankiang, 1.

201. **Paguma larvata hainana** Thomas

HAINAN MASKED CIVET

Paguma larvata hainana Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 3, p. 377, 1909.
Paguma larvata J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 479, 1906 (not of authors).
Paradoxurus (Paguma) larvatus hainanus J. A. Allen, *ibid.*, vol. 26, p. 240, April 17, 1909.

Type specimen:—An immature male, No. 99.9.2.1, in the collection of the British Museum, from Five-finger Mountains (Wuchih), island of Hainan, China.

Description:—In size and general appearance like the mainland race, but the general coloration of the body yellowish rufous instead of gray or gray tinged with buff.

Measurements:—No measurements of adults are available. The size is, however, probably not different from that of the mainland race.

The skull of an adult female measured: occipito-nasal length, 197 mm.; palatal length, 51; zygomatic width, 58; interorbital width, 20.5; mastoid width, 37.5; upper cheek teeth, c-m^2, 36.

Nomenclature:—By a curious coincidence, Thomas named the island race *P. l. hainana*, in a paper published about the tenth of April, and J. A. Allen independently described it, using the same subspecific term in a paper

dated April 17, 1909. The former author is, therefore, the authority for the name.

Occurrence and Habits:—Apparently the Masked Civet was not known to Swinhoe from the island of Hainan. The first record of its occurrence there is that of J. A. Allen (1906, p. 479), who briefly mentions a female from Cheteriang. In his later paper (1909) he made this the type of his *P. l. hainanus*. The locality is in the mountains near the southern border. In 1923 Mr. Clifford H. Pope collected several young specimens of the Masked Civet at Nodoa and Namfong, where, however, it does not seem to be common. The Chinese frequently tame this animal, and such pets are said to make excellent ratters. This race is believed to be confined to the island of Hainan, but when specimens from the adjacent mainland are available, they will doubtless be found very similar, grading into the typical race.

Specimens examined:—Seven, of which three are skulls. All are immature. Hainan: Namfong, 2; Nodoa, 5.

Genus **Herpestes** Illiger

THE MUNGOOSES

Herpertes (*sic*, corrected to *Herpestes* in Errata, p. 302) Illiger, Prodromus Syst. Mamm. et Avium, p. 135, 1811. *Calogale* Gray, Proc. Zool. Soc. London, 1864, p. 560. J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 47, p. 160, 1924.

The mungooses form a well-defined group, now usually regarded as constituting a subfamily of the Viverridæ, but Pocock has even urged that they be recognized as a separate family. They are characterized by their long, slender and weasel-like bodies, fairly long tails, coarse-haired and tapering, and by the broad, low and rounded ears in contrast to the larger narrower ears of the more typical civets. They are ground-living in habits, though occasionally ascending among the larger branches of trees.

The skulls are characterized by the short, blunt muzzle and well-developed postorbital processes, which nearly or quite meet a process of the jugal to form a bony ring about the eye. The posterior portion of the audital bulla is roundly inflated, the paroccipital processes short and inconspicuous. The teeth are of the sectorial type, corresponding to the carnivorous habits of the group. The fourth upper premolar has the antero-internal lobe much larger than the external one corresponding, and provided with a well-developed cusp. The main cusp of the tooth is situated slightly in front of the middle of the outer length, and the posterior heel is provided with a cutting edge. The

molars are very much narrowed anteroposteriorly so that the protocone is separated by a long narrow isthmus from the paracone and metacone at the outer edge of the jaw.

The mungoose group is best developed in Africa, and is characteristic of the tropics and subtropics, taking the place to a great extent of the weasels. Only two species are known to occur in China, and, although these have been sometimes regarded as representing distinct genera, they may for the present both be retained under *Herpestes*. The genotype is the large *Viverra* (=*Herpestes*) *ichneumon* of the Mediterranean region.

KEY TO THE CHINESE SPECIES OF *Herpestes*

A. Size smaller, skull length about 65 mm., no white shoulder stripe..... *H. rubrifrons*
B. Size larger, skull length about 95 mm., a white shoulder stripe..... *H. urva*

202. **Herpestes rubrifrons** (J. A. Allen)

RUFOUS-FACED MUNGOOSE

Mungos rubrifrons J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 240, 1909.
Herpestes sp., Swinhoe, Proc. Zool. Soc. London, 1870, p. 228.
Herpestes griseus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 479, 1906 (not of authors).
Herpestes rubrifrons G. M. Allen, Amer. Mus. Novitates, no. 359, p. 9, 1929.

Type specimen:—No type specimen is designated in the original description, although in the list of measurements it is stated that the type is a male, hence No. 27596, American Museum of Natural History, from Mount Wuchih, Hainan.

Description:—General color of the neck, body, tail, and limbs except the feet, a grizzled olive-brown, barely lighter on the sides. The fur when parted is seen to consist of an under fur of shorter, finer hair which is slaty at the base and pale ochraceous rufous terminally, overlain by long guard hairs, having two or three rings of buffy gray alternating with equal rings of black and a blackish tip. The under fur hardly shows through, so that the general coloring is due to the minute ticking of buffy gray and blackish brown. The sides of the face and the fore and hind feet are clear bright ferruginous, the forehead similar but somewhat darker and mixed with annulated, black-tipped hairs. Tail like the back above, distichous in form, the hairs of the middle third longest, their tips pale ochraceous in the distal half of the tail, giving it a yellower tinge than the back. Middle area of the throat, chest, and belly dull ochraceous, with very few annulated hairs. Chin slightly more rufous. Tail

slightly more rusty in ventral aspect, the terminal third becoming distinctly rufous.

Measurements:—No measurements of fresh specimens were available to J. A. Allen, who gives for a well-made skin, total length about 600 mm.; tail, 240; hind foot without claws, 60. Two, measured by Mr. Clifford H. Pope, gave: head and body, 315, 300 mm.; tail, —, 220; foot, 58, 58; ear, 19, 11, for a male and a female, respectively.

CRANIAL MEASUREMENTS OF *HERPESTES RUBRIFRONS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
59923	67.0	62.5	35.0	30.2	25.0	22.5	25.0	27.7	♂	Hainan
60069	73.0	69.3	39.0	36.5	26.4	22.3	26.3	29.8	♂	Hainan
60071	70.5	67.3	38.0	37.0	25.3	22.0	26.8	29.0	♂	Hainan
59924	65.0	62.0	35.6	31.6	23.0	20.0	24.5	27.0	♀	Hainan
59925	57.5	54.3	30.0	27.5	22.0	20.0	22.2	24.5	♀	Hainan
59928	66.5	62.0	35.0	32.3	22.0	21.0	25.0	27.7	♀	Hainan
60068	64.5	60.7	35.1	31.0	23.8	20.0	24.0	26.4	♀	Hainan

From these measurements it is seen that females average a little smaller than males.

Nomenclature:—As mentioned in his original description, the author of this species recognizes its close relationship with the Javan Mungoose, *Herpestes "javanicus"* and its representatives of the Malay Peninsula, of which this may be an insular race, but until an adequate review of the group can be made, it may stand as a distinct species.

Occurrence and Habits:—Swinhoe in 1870 mentioned the occurrence of a mungoose on Hainan, but was unable to secure specimens. A good series was obtained at Nodoa and Namfong, however, by Mr. Clifford H. Pope, and these agree with Dr. J. A. Allen's description based on eight other specimens from the island collected a few years earlier. Mr. Pope writes that they were common about Nodoa, and he twice saw them by day in open, rolling, bushy country, running from one clump of bushes to another. Those brought in alive were fierce and fearless in disposition, and would make sudden threatening jumps toward one, glaring fiercely and emitting a hissing or spitting sound. Twice he observed closely a fight staged between a mungoose and a cobra. The mungoose's tactics seemed to be to bite the upper fore part of the snake's head repeatedly, regardless of what the snake did. It seemed to have little concern about being bitten in the face, but took especial care that the snake's fangs did not reach its body. "I could not see that in either fight the mungoose went for the back of the snake's head but rather it seemed not to think

of doing so until the snake was about finished. The mungoose bites as the snake strikes and the two pairs of jaws are often locked. It fearlessly meets the snake's onslaught head on and gives bite for bite. When it begins to get the advantage, the length of its hold increases, while now and again it holds on long enough to give a vicious shake, ending by crunching the snake's head and neck between its long teeth."

Mell (1922) records a skin he obtained on Gunjam Shan, a mountain in the north of Canton, Kwangtung, yet within the city limits. It was identified as of this species by Matschie. The animal was captured inside an old mortar, where it had been sleeping, and constitutes the only record of this species or its group from continental China.

Hilzheimer's *Herpestes leucurus*, later changed to *H. albifer*, from China, proved to be a squirrel skin, probably *Callosciurus*.

Specimens examined:—Nine from Hainan, namely, Namfong, 1; Nodoa, 8.

203. **Herpestes urva** (Hodgson)

CRAB-EATING MUNGOOSE

Gulo urva Hodgson, Journ. Asiatic Soc. Bengal, vol. 5, p. 283, 1836.

Urva cancrivora Swinhoe, Proc. Zool. Soc. London, 1870, p. 630.

Herpestes urva Anderson, Anat. and Zool. Researches Western Yunnan, p. 191, 1879.

Urva hanensis Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 190, 1908.

Mungos urva J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 242, 1909.

Herpestes cancrivora hanensis A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 31, 1929.

Herpestes urva sinensis Bechthold, Zeitschr. f. Säugetierk., vol. 11, p. 152, March 13, 1936. Lungtao Shan, Kwangtung.

Type specimen:—Not specified.

Description:—This is a considerably larger species than *H. rubrifrons*, of a uniform coarsely grizzled pelage of black and buffy or whitish; feet dusky brown; tail like the back, becoming whitish to buffy or ochraceous terminally. A conspicuous white stripe runs from the corner of the mouth to the shoulder, not very sharply defined. Chin and throat whitish to gray. There is considerable individual variation in color within narrow limits, in the extent of the white tipping to the longer hairs, the amount of white or brown on chin, throat and feet, and in the intensity of the buffy tint, so that in some the under fur is almost whitish, in others rusty (the *H. u. sinensis* of Bechthold).

The skull is proportionally less elongate than in *H. rubrifrons*, and differs notably in the shape of the audital bullae, which lack the pronounced inflation of the anterior portion seen in the latter species, so that they are almost pear-shaped instead of egg-shaped as seen from below.

Measurements:—An adult female from Yenping, Fukien, measured approximately: head and body, 550 mm.; tail, 220; hind foot, 105.

CRANIAL MEASUREMENTS OF *HERPESTES URVA*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
57029	97.0	90.5	52.5	52.0	39.4	31.7	35.8	41.0	♂	Fukien
60188	97.0	90.0	53.0	53.0	38.4	32.0	35.7	41.6	♂	Fukien
84440	98.4	89.6	53.0	56.5	40.7	33.0	36.3	41.0	♂	Fukien
84441	97.5	89.0	52.0	53.0	39.2	33.0	35.7	41.7	♂	Fukien
60186	102.0	93.0	52.3	53.8	40.8	34.0	37.8	42.4	♂	Fukien
60189	97.5	92.8	53.8	54.0	39.7	34.5	39.0	43.0	♂	Fukien
60151	98.0	92.6	54.0	56.8	40.7	34.8	38.5	43.2	♂	Fukien
57030	98.2	91.0	52.0	55.0	39.0	33.8	36.0	41.0	♀	Fukien
59963	94.2	88.0	49.0	53.0	39.3	33.0	36.5	40.5	♀	Hainan
60127	98.0	89.3	52.3	53.0	40.0	33.5	35.5	41.4	♀	Fukien
60150	96.0	89.5	50.0	54.3	40.0	32.2	36.5	41.3	♀	Fukien
60185	95.0	87.3	49.5	54.5	40.3	34.4	35.0	40.0	♀	Fukien
84443	94.0	86.0	51.0	48.0	38.0	32.6	35.0	39.3	♀	Fukien
84444	98.2	91.2	54.2	53.2	40.0	32.0	37.0	41.4	♀	Fukien

It will be seen from these measurements that there is practically little difference in size between males and females.

Nomenclature:—Although the Crab-eating Mungoose is very distinct in its cranial and color characters from the other eastern mungooses, it does not seem at present that it should be accorded more than subgeneric distinction, as A. B. Howell has advocated. No doubt, however, when a more thorough study of the Asiatic species is made, there will be those who will regard it as worthy of separate generic rank under the name *Urva urva*. There seems to be but a single well-defined species, extending from Assam to South China, but Matschie in 1908 gave the name *Urva hanensis* to the Chinese animal, on the basis of four skins purchased at Hankow, which he supposed differed from the typical form in having the chin brownish gray much mixed with white instead of all white, the under fur of the head dark brown with a gray tone instead of light reddish brown, the under side ochraceous instead of dull brown, and the tail 250 mm. instead of 275—300 mm. In the various details of color, the considerable series examined shows that there is much individual variation, as already noted, and the tail measurement taken from trade skins cannot be regarded as very significant. I have, therefore, relegated this supposed species to the synonymy of *H. urva*, although A. B. Howell has used the name *hanensis* in a subspecific sense for specimens from eastern China, *Herpestes cancrivora hanensis*. Although Hodgson proposed *cancrivora* as a specific name in 1837, his *G. urva* was published for the same animal in the preceding year and so has priority.

Occurrence and Habits:—The Crab-eating Mungoose seems to be common over parts of South China, extending as far north as the mouth of the Yangtze on the eastern coast, where the most northern record is Chinkiang, Kiangsu. To the westward, however, I have no certain records for it, although Matschie's type of *Urva hanensis* from Hankow may not have come from a great distance. Anderson (1879) mentions a specimen in the Paris Museum from Kiangsi, and Swinhoe (1870c) recorded one from the Fukien Hills near Amoy. It is apparently common in Fukien, for the American Museum's collections include a number from Futsing and Yenping, as well as one from Chunganhsien, in the northwest corner of the province. Mr. Clifford H. Pope writes me that he found it common near streams in the mountainous sections of Futsing. "It is also commonly seen among the terraced rice fields in the mountainous regions, where it is said to find the loaches of which it is supposed to be very fond. The native name, 'ni ch'iu mao', signifies 'loach cat', and it is also sometimes called 'blind cat' in reference to its apparent nearsightedness, for it may be approached more readily than most wild animals. Several, when alarmed, are prone to dash about in circles, one following close behind another." Swinhoe (1872) writes that it is attracted by crabs, near Ningpo, and it is in general found along banks of streams. Shih (1930, p. 5) says that he has seen it in Nanning for sale in cages, and it is said to be a good "ratter." Mell (1922) found it not uncommon in both north and south parts of Kwangtung. A female with her two young was brought him at Wampu. Its presence in the island of Hainan does not seem to have been known until Dr. J. A. Allen (1909, p. 242) recorded an old female from Mount Wuchih, in 1909. Others were secured at Nodoa, Hainan, by Mr. Clifford H. Pope. Hitherto no collectors seem to have met with it in Yunnan.

Specimens examined:—Thirty-seven, as follows:

Kiangsu: Chinkiang, 1.
Fukien: Futsing, 15; Chunganhsien, 1; Yenping, 13.
Hainan: Nodoa, 6.
No exact locality, 1.

Family FELIDÆ

CATS

The cat family includes beasts of prey in which the specialization of habit and structure has progressed along lines quite opposite to those seen, for example, in the dog group. The fur is fine and dense instead of coarse; the habits are usually of the skulking type, and the prey is stalked rather than run down; the claws, in all but the cheetah, are retractile, preventing them from becoming blunted; the entepicondylar foramen in the humerus is usually present, whereas, in such running species as the dogs, it is lost. The skull

conforms in a similar way, for whereas in dogs it is long, with a pointed muzzle, as if for reaching toward the quarry, in the cats it is short and blunt. The teeth in the Felidæ have undergone considerable reduction in number, for, although the incisors are, as typically in Carnivora, six above and below, the premolars are but three or sometimes two in the upper jaw and two in the lower, while the molars are but one above and one below on each side. The last upper premolar is specialized as a sectorial tooth, shearing against the blade of the first lower molar, in which the heel, so prominent in the Canidæ, is reduced to practically nothing, leaving the paraconid and protoconid with their sharp edges to form the blade. The upper molar is a practically functionless tooth, with a single root, and small oval crown, set with its long axis transverse to that of the tooth row.

The typical cats have rather long tails, untufted ears, and usually three upper premolars; the lynxes have short tails and high hind quarters, tufted ears and usually two upper premolars, through the loss of the small pm^2. According to Pocock (1917), the lynxes are closely allied to the small typical cats.

Cats comprise many species of varying size and proportions, from the house cat to the leopard, tiger, and lion. Various attempts to subdivide this aggregation into genera and subgenera have been made, with varying degrees of success, since the differences relied upon are largely quantitative. The ultimate result has been on the one hand to regard all the forms as species of *Felis*, or on the other to make each well-marked type the representative of a distinct genus or subgenus. The latter course was taken by Severtzov, who in his paper of 1858, reviewed by J. A. Allen (1919), divided the family into five genera and twenty-seven subgenera. More recently, Pocock (1917), in his review of the classification, went more thoroughly into the matter and divided the group into three subfamilies, based largely on the condition of the suspensorium of the hyoid bones. These subfamilies are: (1) the typical cats or Felinæ, mostly smaller species, in which the suspensorium is ossified, holding the larynx close up to the base of the skull; (2) the larger species, Pantherinæ, in which the suspensorium is imperfectly ossified, "its inferior portion consisting of a larger or shorter elastic tendon conferring great mobility upon the larynx" (includes leopards, tigers, lions); and (3) a special subfamily, Acinonychinæ, for the cheetah, which, although agreeing with the Felinæ in the structure of the larynx, differs in the lack of folds of skin to protect the claws. Pocock then subdivides his subfamily Felinæ into thirteen groups of generic rank, while recognizing but two genera of Pantherinæ, namely, *Panthera* for the lion, tiger, leopard and jaguar, and *Uncia* for the snow leopard. Lönnberg (1925) has since added the subgenus *Poliailurus* for *Felis pallida*, and Ognev two years later added the genus *Eremælurus* for a new species,

E. thinobius, from the Transcaspian region. In his review of Russian cats, Ognev (1930) considers most of the genera of smaller species that Pocock recognized, as constituting subgenera only of *Felis*. Other authors have given generic rank to some of the groups and subgeneric to others. Until our knowledge of the group as a whole is more thorough, the conservative course seems to be to give subgeneric standing to most of these groups, for so closely related in general characters are the cats, that intermediate modifications can be found bridging over almost any apparent differences that individuals show. Having once become established, the type seems to have varied more in size and color pattern in accordance with the size of its prey and habitat, than to have acquired much structural differentiation.

KEY TO THE CHINESE AND MONGOLIAN FELIDÆ

A. Cats of small to medium size; suspensorium of the hyoid apparatus ossified, holding the larynx close to the base of the skull..... Subfamily Felinæ

a. Tail relatively long, at least twice the length of the hind foot; ears not usually penicillate; nasals usually rather abruptly contracted about half-way back.

a′. Smaller, about the size of a house cat; muzzle short, the distance from orbit to gnathion less than the long diameter of the eye; postorbital processes long, nearly or quite meeting those of the jugal.

a″. No white mark across the back of the ear.

1. Upper premolars three.

a. Jugal ending anteriorly below the lachrymal foramen; nasals turned slightly upward and outward distally..... Subgenus *Felis*

a′. Backs of ears reddish..... *Felis chaus affinis*

b. Jugal reaching lachrymal foramen and bending inward as a narrow branch; nasal profile concave in its middle third..... Subgenus *Poliailurus*

a′. Backs of ears like the back in color... *Felis bieti*

2. Upper premolars two; jugal ending anteriorly in a narrow tapering point, continued upward to meet the frontal in advance of the lachrymal foramen..... Subgenus *Trichælurus*

a. General color grayish buff, with little trace of cross-banding..... *Felis manul manul*

b″. A white mark across the back of the ear; a complex body pattern of stripes and blotches; nasals depressed, sloping evenly downward..... Subgenus *Prionailurus*

a. Ground color brighter buffy..... *Felis bengalensis bengalensis*

b. Ground color averaging paler..... *Felis bengalensis chinensis*

b′. Larger, the distance from orbit to gnathion greater than the long diameter of the eye; postorbital process not closely approaching the jugal process; backs of ears lacking a white cross-mark.
a″. Body usually without markings, rarely with a pattern of longitudinal stripes and rows of spots; lower canines not specially elongate..... Subgenus *Profelis*
a. ..... *Felis temminckii tristis*
b″. Body marked with large, somewhat squarish blotches, consisting of sections of pale ground color enclosed by narrow blackish edges, often incomplete; canine of lower jaw large, so that the profile of the chin is nearly vertical..... Subgenus *Neofelis*
a. ..... *Felis nebulosa*
b. Tail relatively short, less than twice the length of hind foot; ears with a long pencil; upper premolars two; nasals not abruptly contracted in their middle length..... Genus *Lynx*
a. ..... *Lynx lynx isabellina*
B. Cats of large size; suspensorium of the hyoid apparatus long and chiefly cartilaginous..... Subfamily Pantherinæ
a. Rostrum not shortened, the distance from orbit to gnathion considerably exceeding the diameter of the eye.. Subgenus *Panthera*
a′. Pattern consisting of rounded spots and rings of black on an ochraceous ground..... *Felis pardus*
1. Ground color deeper ochraceous, coat shorter. *Felis pardus fusca*
2. Ground color paler, coat longer..... *F. p. fontanierii*
b′. Pattern consisting of transverse stripes on a rufous-ochraceous ground..... *Felis tigris*
1. Ground color richer, coat shorter..... *Felis tigris amoyensis*
2. Ground color slightly paler, coat longer..... *Felis tigris amurensis*

Probably to this list will eventually be added the Snow Leopard, *Felis* (*Uncia*) *uncia*, a species characteristic of the steppes and barren mountainous country of central Asia. No specimens have apparently ever been taken in Chinese territory, and few white men have shot it in its native haunts. A number are annually killed in Tibet and brought over the border into China, whence they find their way into fur markets, but probably none of these is killed inside the borders of China. Nevertheless, Mr. Brooke Dolan, on his recent expedition into the highlands of extreme western Szechwan, tells me that he tracked a leopard in the snow on a barren mountain peak close to the Tibetan border, which he surmised must be this species, for the country was not at all the sort that the true Leopard would choose. Pocock has studied the cranial characters of this beautiful marbled species, and believes that it should stand as a separate genus, characterized by the type of suspensorium peculiar to the Pantherinæ, but with the profile of the skull very steeply sloping downward.

Genus **Felis** Linnæus

Subgenus **Felis** Linnæus

Felis Linnæus, Syst. Nat., ed. 10, vol. 1, p. 41, 1758.
Chaus Gray, List Mamm. Brit. Mus., p. 44, 1843.

The type of the genus *Felis* and of the subgenus as well, is the Domestic Cat, *Felis catus* Linn., usually regarded as descended from the Wild Cat of northern Africa, a form of *Felis libyca*. Possibly, however, as Pocock has suggested, the ancestry may be mixed, with a certain amount of blood of the European Wild Cat, *F. silvestris*. The typical group consists (1) of small species with the tail about as long as the body, as in *F. silvestris* and *libyca*, found chiefly in Africa and western Eurasia, and (2) the shorter-tailed forms, *F. chaus* and its allies, of which one race seems to extend to the western borders of China. Satunin (1905) described as *Felis kozlovi* what seems to be an eastern race of the *F. silvestris* of Europe, from Lukchum, eastern Tienshan, on the 90th degree of longitude east from Greenwich. It may eventually prove that this type also will be found to reach the western parts of China and Mongolia.

Pocock enumerates among the external characters of typical *Felis*, the short, broad head, reduced rhinarium, large, pointed and sometimes penciled ears never showing the white spot on their back, the vertically contracting pupil and rather small feet. The skull is characterized by the short rostrum (distance from the edge of the orbit to the gnathion less than the long diameter of the eye), the nasals which are suddenly contracted in their posterior half, and end proximally in a depression, while anteriorly they are everted, opening up and out; the ascending branch of the premaxillary is slightly narrowed and tapered posteriorly, the postorbital processes nearly meet those corresponding from the jugal, and there is normally a minute anterior premolar in the upper jaw.

Apparently only one species of the typical subgenus occurs in China.

204. **Felis chaus affinis** Gray

INDIAN JUNGLE CAT

Felis affinis Gray, Illustrations of Indian Zool., vol. 1, pl. 3, 1830 (date on plate, 1829).
Felis chaus affinis De Winton, Ann. Mag. Nat. Hist., ser. 7, vol. 2, p. 291, 1898.

Type specimen:—The name is based on Gray's plate of an Indian specimen from Gangootra, India.

Description:—A cat slightly larger than the House Cat, distinguished by its lack of darker markings in the way of spots or stripes. The entire dorsal side of the body from the occiput to the basal half of the tail is a uniform mixture of buffy-tipped hairs with others ringed with buffy and tipped with black, the latter slightly more abundant over the median area of the lower back, where also the buffy-tipped hairs become pale rusty. On the muzzle, forehead

and cheeks the black-tipped hairs are absent, leaving these areas almost uniform pale rusty, and the same tint, a trifle brighter perhaps, extends across the lower throat, and the middle of the chest and belly, the forearms, fore feet and wrists, the hind feet, ankles and inner side of the tibial joints. Chin and upper throat, the chest between the fore legs, and the inguinal region nearly white, the last slightly tinted with pale ochraceous. There is a trace of a whitish short stripe at the inner corner of each eye, and the long hairs lining the ears are whitish. A small dark spot is present anterior to the eye. Backs of the ears ferruginous, their tips blackish, without trace of the white transverse bar seen in certain other groups of cats. Tail like the back on its basal half, developing an indistinct dorsal stripe with three or four half-rings of blackish and a blackish tip distally; underneath, the tail is buffy, with the black tip extending all around in the last 25 mm. or so.

The skull shares with that of *F. bengalensis* the short rostrum (distance from orbit to gnathion less than long diameter of orbit), the pinched-in nose, long postorbital processes and broad ascending process of the maxillary. The structure of the jugal, with a slender branch passing outside of the lachrymal foramen and ascending to meet the prolongation of the frontal, is peculiar, and the eversion of the tips of the nasals is less than in the house cats. There is a deep emargination of the palate at its posterior edge, the notch extending forward nearly to the level of the middle of the carnassial. The small upper first premolar is well developed.

Measurements:—A skin and skull from Darjeeling, India, measure: the skin approximately, head and body, 615 mm.; tail, 230; the skull: greatest length, 105 mm.; basal length, 86; palatal length, 38; zygomatic width, 69; mastoid width, 42; width outside carnassials, 40; upper cheek teeth, 32.6; lower cheek teeth, 36.1.

Occurrence and Habits:—According to De Winton (1898), who reviewed the group, the Indian Jungle Cat is readily distinguished from typical *Felis chaus chaus* of the Caucasus region and Persia, by its rather longer tail, bright fox-red ears, and lighter build, while the skull is slightly narrower, with lighter, less-crowded teeth. Although it occurs throughout the greater part of India, there seem to be no records of its presence in China. The American Museum Asiatic Expeditions, however, obtained a native skin on the Burma border at the Namting River, which, if locally killed, indicates that the range extends a short distance into southwestern Yunnan.

It is said that in India this cat interbreeds with the domestic form.

Specimens examined:—One only, a skin from Namting River, Yunnan.

Subgenus **Poliailurus** Lönnberg

Poliailurus Lönnberg, Arkiv f. Zool., Stockholm, vol. 18A, no. 2, p. 2, 1925.

This subgenus was proposed for the peculiar desert cat, *Felis pallida* (=*bieti*), the skull of which remained unknown until 1925, when Lönnberg published a description with figures showing its peculiarities, and erecting a special subgenus for the animal. Previously, with only skins for study, its relationships had been supposed to lie with *Felis chaus*. The important points brought out by Lönnberg as characterizing the subgenus are: (1) the much more globular brain case; (2) the peculiar shape of the nasals, which in profile are concave in the middle third and convex upward distally; (3) the broad interorbital region; (4) the very large bullæ, with large auditory meatus; (5) the anterior end of the jugal, forming the lower rim of the orbit to the level of the lachrymal foramen, but bending inward so that the rim of the orbit from that point to the frontal is formed by the maxillary; (6) the small anterior premolar is present and the second upper premolar has a small but distinct anterior cusp.

Notwithstanding these peculiarities, it seems likely that the species is closest related to the Chaus. Although names have been given to slightly differently-colored specimens from different parts of western China, it seems more than likely that these pertain to individual variants rather than to distinct geographical races, but until a sufficient series can be studied, this must remain uncertain, for cats vary very much in the tone and pattern of their markings. At present, therefore, only the one species is here recognized.

205. **Felis bieti** Milne-Edwards

THE PALE DESERT CAT

Felis bieti Milne-Edwards, Rev. Gén. des Sci. Pûres et Appliqués, vol. 30, p. 670, October 15, 1892. Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 4, p. 357, 1898.

Felis pallida Buechner, Bull. Acad. Imp. Sci. St. Pétersbourg, vol. 35 (new ser., vol. 3), p. 433, November, 1892. South Tatung Range, Kansu.

Felis chaus pallida De Winton, Ann. Mag. Nat. Hist., ser. 7, vol. 2, p. 291, 1898.

Felis chutuchta Birula, Annuaire Mus. Zool. Acad. Sci., Petrograd, for 1916, vol. 21, Nouv. et Faites Divers, p. i, 1917. Southern Gobi.

Felis pallida subpallida Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 9, 1922. Near Sungpan, Szechwan.

Type specimens:—No types are specified in the original account, nor is any specific locality given by Milne-Edwards, but Pousargues (1898a) later explained that two specimens were brought back by Prince Henri d'Orléans from the vicinity of Tongolo and Tatsienlu, Szechwan, China, and these formed the basis of the name. Both are therefore cotypes, and are in the Muséum d'Histoire Naturelle at Paris.

Description:—About the size of a house cat, with a nearly uniform colora-

tion practically lacking any stripe or spot pattern. The upper side of the head and body, and outer side of the limbs are yellowish gray, thickly and irregularly ticked with blackish or dark-brownish guard hairs; the latter are yellowish at the base, then blackish, followed by a grayish portion occupying nearly half the length of the hair, and tipped with black. Under fur soft, slaty at its base, tipped with brownish. On the sides the grayish portion of the longer hairs is more extensive, giving a paler tone to this area, as the blackish tips become shorter. On the outer side of the haunches there may be three or four indistinct dark cross-bands, and there is a broad brownish cross-band on the inner side of the forearm. The upper side of the head, although in general colored like the back, has at the base of each ear a uniformly pale reddish-brown area; the backs of the ears are like the back in color, without the white cross-band and with a short pencil of hairs about 20 mm. long; the area about the muzzle is brownish. Across the cheeks are two indistinctly marked brownish stripes, the lower of which begins near the edge of the upper lip, and below the eye, continuing slightly behind the angle of the mouth, while the upper starts from the lower eyelid, and, running across the cheek, curves downwards to join the lower stripe; between them is included a light-gray area. Lower lips and chin white, the throat washed with yellowish brown; the rest of the under parts white, with the yellowish-brown under fur showing through. Tail with three or four blackish rings in the terminal part, separated by whitish rings, and the tail-tip black; there may also be some three indistinct dark rings in the basal portion, with the area between them colored like the back.

The above description is from Buechner (1892b), but there are apparently slight variations in the ground color, or in that of the under fur, tending to a slightly more rufescent coloration; some specimens, such as that described by Birula (1917a) as *Felis chutuchta*, show faint cross-bands on the body, and five indistinct longitudinal stripes on the occipital region, with a transverse broad rufous band across the lower throat.

The general characters of the skull have been described in detail by Lönnberg, who emphasizes especially the large globular brain case, inflated audital bullæ, the peculiar short nasals, with a concavity in their middle third, the anterior termination of the jugal bending downward at the level of the lachrymal canal, so that the maxillary forms the anterior rim of the orbit, the relatively weak dentition, in which the small anterior premolar is present in both jaws, and the presence of a distinct but small cusp at the anterior end of the upper carnassial.

Measurements:—There are apparently no flesh measurements available for this species, for, with the exception of Lönnberg's specimen of skin and skull, nearly all the previously known specimens appear to have been trade

skins, of which the published measurements must be regarded as approximate only. These are:

	Head and body	Tail	Ear
BUECHNER (1892b)	685	325	58
	775	321	67
JACOBI (1922)	830	350	—
	840	350	—
BIRULA (1917a)	600	230	60
MATSCHIE (1908)	820	345 (with hair)	—

For the skull of the female from Min Shan, Kansu, Lönnberg has published the following measurements: condylobasal length, 94 mm.; zygomatic width, 74.5; mastoid width, 47; width across molars, 41; width of brain case, 51.2; orbit to gnathion, 27; pm^3-m^1 inclusive, 22. A female skull, from the southern Gobi, type specimen of Birula's *F. chutuchta*, measured: greatest length, 97 mm.; basal length, 89; zygomatic width, 70.1.

Nomenclature:—This cat has usually gone under the name of *Felis pallida*, but Pousargues (1898a, p. 357) points out that Milne-Edwards's paper describing the same animal as *Felis bieti*, was published October 15, 1892, while Buechner's bears the publication date of November in the same year. The type locality of *F. bieti* is the Tatsienlu district of Szechwan, and that of *F. pallida* is Kansu, in the Tatung Range, localities not more than four hundred and fifty miles apart. They are apparently not sufficiently different to be even racially distinct. The cat described by Birula (1917a) as *Felis chutuchta*, is also, so far as the description indicates, much the same, except that it is more rusty in coloring and with more indication of occipital stripes than described by Buechner. It would be expected that the general coloring, as in *F. bengalensis*, might vary to a rusty tone. The two specimens on which it was based came from the Gobi of southern Mongolia, "ad locum (=?lacum) Nor in Provincia Goizso," and were collected by Kozlov in 1908. Jacobi (1922) gave the name *Felis pallida subpallida* to two trade skins brought back by the Weigold Expedition from Sungpan, in northwestern Szechwan, about two hundred miles north of the type locality of *F. bieti*, basing his distinction on the fact that the stripes on the haunches seemed clearer, and the general tone of coloring darker. Nevertheless, it seems more likely that these slight differences are individual variations, similar to those seen in other cats, rather than geographic or subspecific in value. I am, therefore, for the present regarding this also as a synonym.

Occurrence and Habits:—This is a rather uncommon species, notwithstanding that its pelt seems often to reach the centers of fur trade. The two brought back by Prince Henri d'Orléans from Tongolo and Tatsienlu, in central Szechwan, later the types of the species, seem to be the most southerly

record available. Passing northward, the animal apparently occurs sparingly all along the western borders of Szechwan and Kansu, and thence westward to an unknown distance. Jacobi's two skins from Sungpan, northern Szechwan, bridge the gap to Min Shan, southwestern Kansu, whence D. Sjölander secured the specimen that formed the basis of Lönnberg's description of the skull (1925). The latter author adds that Birula, in a letter, mentioned that the Zoological Museum of the Academy of Sciences, Leningrad, has since obtained six more skins, but the localities are not given. Matschie (1908, p. 205) recorded a skin from Kweito, extreme western Szechwan, not far south of Buechner's type locality, secured by the Filchner Expedition. Finally it is likely that Birula's *Felis chutuchta*, from the Gobi of southern Mongolia, in Goizso, is really the same animal. Nothing is known of its habits, but it seems probable from its type of coloration that it is an inhabitant of rather barren country on the edge of the Tibetan and western Chinese steppes. It may be doubted if the specimens secured in the fur markets of Tatsienlu and Sungpan were locally obtained; more likely they came from the borderlands of the extreme western edge of China or even from Tibet. Weigold (1923) writes that it was probably this species whose tracks he found in the snow in January in the wooded mountains of Wassuland. One of the specimens he secured was caught in a snare set for Musk Deer in July; the other was purchased in a store. On another occasion, his foxhound in early evening chased one, in the mountains east of Sungpan, where at an altitude of 3,000 meters, the country is covered with low thickets. Apparently the dog fought the cat, and returned with two bites in its jaw. On the following day, the cat was found in the same place, but offered only a snap shot, and escaped.

Specimens examined:—None.

Subgenus **Trichælurus** Satunin

Trichælurus Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1904, vol. 9, p. 495, 1905.
Otocolobus Severtzov, Rev. et Mag. de Zool., ser. 2, vol. 10, p. 386, 1858 (not of Brandt, 1844).

These desert cats are regarded by Pocock as forming a separate genus, intermediate in certain ways between *Felis* and *Lynx*. With the former they share the general size and proportions of tail to body, while with the latter they have in common the rounded pupil of the eye, narrower premaxillæ, shallow notching of the suborbital edge of the palate, and the loss of the first upper small premolar. The more striking peculiarities of the skull, as listed by Pocock, are: its width, the steep slope of the profile from about the middle of the orbit, the prolongation of the jugal bone forward in front of the lachrymal foramen to join the anterior tip of the frontal; the palate wider than long, the large bullæ, whose forward end is slightly in advance of the glenoid ridge, and their large outer chamber, equaling the inner. The ascending process

of the jugal nearly or sometimes quite joins the postorbital process, thus forming a bony ring about the eye.

The type species of the subgenus is *Felis manul* Pallas.

206. **Felis manul manul** Pallas

PALLAS'S CAT

Felis manul Pallas, Reise durch versch. Provinzen d. Russ. Reichs, vol. 3, appendix, p. 692, 1776. Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 225, pl. 31C, 1868-74 (1872).

Trichælurus manul mongolicus Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1904, vol. 9, p. 501, 1905 (not *Felis tigris mongolica*, nomen nudum).

Felis manul satunini Lydekker, Game Animals of India, p. 334, 1907.

Otocolobus manul Birula, Annuaire Mus. Zool. Acad. Sci., Petrograd, for 1916, vol. 21, p. 130, 1917.

Type specimen:—No type is mentioned in the original account, but it is known that some of Pallas's specimens are preserved at the Museum of the Academy of Sciences at Leningrad, so that possibly a skin of this cat brought back by Pallas from his journey is still in existence there. Pallas states that this cat is found throughout the deserts of Tatary and Mongolia.

Description:—About the size of the European Wild Cat, this species differs remarkably from most cats in the extremely short rounded ears, set low on the head and wide apart. In winter coat the entire body is pale buff, slightly mixed with black and tinged with rufous; several more or less obsolete dark brownish bands across the lower part of the back; head pale gray above with a few black spots; a short white stripe bordering inner corner of the eye, and another bordering the lower eyelid and thence passing back across the cheeks as a broad white streak, edged by a narrow blackish line above and below. The tail is colored like the back, with several more or less obsolete blackish rings, those near the end more conspicuous and forming a black tip. The summer pelage is similar but less thick and full. A specimen apparently in this pelage has the head dark blackish brown, most of the hairs pale-tipped, while from the nape to the root of the tail in the mid-dorsal region, the hair is buffy to pale ochraceous at the base, becoming darker to a buffy brown posteriorly, then narrowly ringed with gray and minutely tipped with black. All-black hairs are sprinkled freely throughout the back. On the sides, the buffy bases and whitish tips are longer and the black tips largely disappear, so the tint is clearer and becomes nearly clear whitish on the belly. The middle of the chin and upper throat are white, but the sides of the throat and the upper chest become conspicuously blackish brown, with a few white-tipped hairs scattered over the area. The hind feet are ochraceous buff. The tail has three black narrow rings about two inches apart, then two more at half that distance apart or less, and an all-black tip.

A kitten from Sungpan retains a thick woolly coat, and quite lacks the complete frosting of white-tipped hairs seen in the adult. The crown, how-

ever, is nearly black with a tinge of brown, while the posterior half of the body has nine narrow transverse black bands across its dorsal half, the posterior stripes continuing across the haunches. The tail has seven spaced black rings, and a black tip.

Measurements:—No fresh-made measurements are available. Birula (1917), however, gives the following cranial dimensions for an adult pair:

CRANIAL MEASUREMENTS OF *FELIS MANUL MANUL*

No.	Greatest length	Basal length	Zygomatic width	Width outside molars	Greatest diameter of orbit	Upper premolars and molar	Lower premolars and molar	Sex
——	92.7	85.8	74.1	43.0	28.6	18.2	22.0	♂
——	84.5	——	66.2	39.8	25.8	18.3	20.5	♀

Birula (1917), from whose paper the above particulars are taken, has given an excellent account of the skull, well illustrated with photographs, and has compared it in detail with that of *Felis silvestris* representing the typical subgenus *Felis*. He concludes that the peculiarities of the Manul are sufficient to warrant giving it generic distinction, a conclusion also accepted by Pocock. The great width of the skull, the relatively very short rostrum, large bullæ, and loss of the anterior small premolar, together with the details of the cusps of the carnassials, if these prove to be constant, are well illustrated in his figures. He shows also the variation that exists in different individuals with regard to the number and distinctness of the transverse body stripes, and concludes that Satunin's race *T. m. mongolicus* is not distinct.

Nomenclature:—The use of Severtzov's name *Otocolobus* for this group of cats is invalidated on account of the previous use of the same name by Brandt for a group of ground squirrels. Satunin was, therefore, right in replacing it by *Trichælurus*, although usage has not been fixed as to whether it shall stand as a genus or a subgenus. If the latter, then Satunin's new race, *Trichælurus manul mongolicus*, becomes invalidated by *Felis tigris mongolica*, as pointed out by Lydekker, who, therefore, proposed the new name *F. m. satunini* in its place. Birula, however, in his review of this group in 1917, does not regard it as valid, a conclusion apparently well founded. Satunin supposed the typical race to occur west of the Gobi, while his *T. m. mongolicus* was the Mongolian race.

Occurrence and Habits:—As a species, the Manul is a desert-living cat, found from Dauuria, Kansu, and the Gobi westward to Dzungaria, and south to southern Tibet, where it is supposed to be represented by the slightly different race, *F. m. nigripectus*. The specimen figured by Milne-Edwards was killed in "Mongolie," near the Great Wall, hence perhaps in northern Hopei at the edge of the desert. It seems to be found throughout the desert country.

Lönnberg (1925) has published notes on three specimens secured by the missionary Eriksson from Hallong Osso in the interior of Mongolia, while Birula (1917), in his extended account of the characters, mentions and figures specimens from Sining, Kansu, and a second from near the Labran monastery, while a third came from the vicinity of Urga on the northern edge of the Gobi. While records are lacking, it probably reaches the desert steppes along the extreme western border of Szechwan as well, for the Brooke Dolan Expedition secured two, one day west of Sungpan. Satunin's type of *Trichælurus m. mongolicus* came from Kjachta, Mongolia.

Pocock (1907) has figured a live specimen of this cat at the London Zoological Gardens, and suggests that the very low, wide-apart ears that seem to give the animal an always angry look, are really an adaptation allowing it to raise its head above very low inequalities of surface such as small rocks, without being so conspicuous to its quarry beyond as it would be if its ears were of the usual erect and pointed type. It is said to prey chiefly on small rodents—spermophiles, gerbils and jerboas.

Specimens examined:—Two skins, one day west of Sungpan, at Manningou, Szechwan (A. N. S. P.).

Subgenus **Prionailurus** Severtzov

Prionailurus Severtzov, Rev. et Mag. de Zool., ser. 2, vol. 10, pp. 387, 390, 1858. J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 41, p. 340, 1919.

The cats of this group are characterized by a conspicuously striped and spotted pattern, consisting of longitudinal stripes from forehead to nape, usually four in number, becoming somewhat broken over the shoulders, although the median pair is traceable to the root of the tail. A white short stripe marks the inner border of the eye, and there is a conspicuous broad white mark on the back of the ear, not extending quite to the inner border. The sides of the body are marked with lengthwise rows of spots, and the tail with some ten or fewer blackish rings. The pattern thus differs from that of the house cat, in which the body markings tend to form transverse rows of spots, the black tail-rings are joined in the mid-dorsal line, and coalesce to form a black tip, while the white ear-marking is absent. The skull differs, in that the nasals are not everted in their terminal third but continue the downward curve of the facial profile. The postorbital process is long and slender, often uniting with that of the jugal to form a complete ring about the eye. The upper first premolar is very frequently missing.

The type species is *Felis pardochrous* Hodgson (=*F. bengalensis*), and, though a number of nominal species related to it have been named, probably all are referable to but one, with possibly two or three subspecies, of which only one, not at all sharply marked off, occurs in eastern and northern China.

207. Felis bengalensis bengalensis Kerr

THE TIGER CAT

Felis bengalensis Kerr, Animal Kingdom of Linnæus, vol. 1, Mamm., p. 151, 1792.
Felis bengalensis var. *pardochrous* Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 2, p. 180 (p. 2 of separate), 1896.
Prionailurus bengalensis Pocock, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 339, 1917.

Type specimen:—Probably not in existence. Pocock (1917) writes that the name is "based upon a specimen that swam on board a ship in Calcutta. The name has been fixed by tradition to the species that bears it; and since the description, so far as it goes, fits the species and most certainly does not apply to any domesticated cat. . . . I see no reason for discarding the term."

Description:—The essential pattern is as follows: with a general ground color above of ochraceous, there are two narrow black stripes, one commencing at the posterior corner of each eye, the other just below the eye, passing back along the side of the jaw and enclosing a white area between them; the lower stripe is more or less continuous across the upper throat with the corresponding stripe of the other side, and there are three or four other imperfect blackish-brown collar-marks on the lower throat; a short but conspicuous white stripe borders the inner and upper edge of the eye; four narrow black stripes run from the upper corner of the eyes along the midline of the neck to the shoulders, with sometimes a fifth narrow median one on the crown and forehead; the two outer of these stripes become broad posteriorly, breaking up into large lengthwise blotches over the shoulders; the inner pair likewise becomes interrupted at the shoulders, but from there they are traceable as a nearly continuous pair of stripes to the root of the tail. The sides of the body are marked by about five longitudinal rows of elongate spots, which may be all black, or more or less surrounded by ferruginous, or the anterior part of the spot may be of the latter color, the posterior part black. The belly has a number of blackish-brown spots on a white ground, which tend to arrange themselves in about four or five transverse rows of rounded markings across the chest and upper abdomen. The tail is buffy with ten or more broken rings of blackish, not connected in the mid-dorsal line, and not forming a black tip, characters which, in addition to the presence of a conspicuous whitish spot in the middle of the back of the ear, will serve at once to distinguish the species from the common house cat.

In the series examined from Yunnan, the ground color is bright buff or yellowish, with a good deal of ferruginous on the shoulder region, not only tinging the ground color, but broadly edging the spots and other markings. In extreme specimens, the body spots may be chiefly bright rusty, narrowly and incompletely bordered with black, while at the opposite end of the series

are skins in which the ferruginous is nearly suppressed, so that the markings show as all-black on an ochraceous-buff ground.

In the skull, the striking features are the long narrow postorbital processes, which almost, or rarely quite, join the pointed process of the jugal to enclose the orbit; the nearly vertical ascending process of the maxillary which abuts against the middle portion of the nasals at the point of their abrupt narrowing, and ends bluntly, without a narrower posterior extension; the termination of the anterior end of the jugal just below the level of the lachrymal canal; and in profile, the even downward curve of the frontals and nasals, so that the latter continue the convex outline of the fore part of the skull instead of turning upward and outward at their tips as they do in the common house cat.

Measurements:—No fresh measurements of the typical race are at hand. Under the subspecies following are included the cranial measurements of the only skull examined. No doubt there is very little difference in size between the two subspecies.

Occurrence:—A series of skins, with but a single skull, secured at Likiang and Weisi, Yunnan, differs from a series from eastern China in having a more buffy ground color, instead of the grayer tone usual in the latter. I have, therefore, regarded them provisionally as representing the typical race, which, according to Wroughton, is the one found in India from southern Baluchistan to Upper Burma and Tenasserim. Two specimens from eastern Szechwan are referred to *F. b. chinensis*, though one is nearly as yellow as the Yunnan specimens. Probably the two races intergrade somewhere in southwestern China.

Specimens examined:—Twelve, namely:

Yunnan: Likiang, 6; Weisi, 4; no exact locality, 2.

208. **Felis bengalensis chinensis** Gray

CHINESE TIGER CAT

Felis chinensis Gray, Mag. Nat. Hist., ser. 2, vol. 1, p. 577, 1837.
?*Felis pardella* Pallas, Acta Acad. Sci. Imp. Petropol., for 1781, pt. 1, p. 281, 1784.
Felis microtis Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 221, pl. 31A; pl. 31B, figs. 1-1b, 1868-74.
Felis decolorata Milne-Edwards, *ibid.*, p. 223.
Felis scripta Milne-Edwards, *ibid.*, p. 341, pl. 57; pl. 58, figs. 1-1c.
Felis euptilura Elliot, Proc. Zool. Soc. London, 1871, p. 760, pl. 76; Monograph Felidæ, pl. 26 and text, 1883 (in part).
Felis macrotis Elliot, Monograph Felidæ, pl. 26 and text, 1883 (*lapsus calami* for *F. microtis*).
Felis ricketti Bonhote, Ann. Mag. Nat. Hist., ser. 7, vol. 11, p. 374, 1903.
Felis ingrami Bonhote, *ibid.*, p. 474.
Felis anastasiæ Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1904, vol. 9, p. 528, 1905.
Prionailurus scriptus Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 201, 1908.
Felis (Prionailurus) scriptus Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 20, 1922.
Felis euptilura microtis Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 8, 1922.

Prionailurus chinensis Cabrera, Bol. Real Soc. Esp. Hist. Nat., Madrid, vol. 22, p. 165, 1922.
Felis bengalensis chinensis Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 9, 1922.
Felis (Prionailurus) chinensis anastasiæ Lönnberg, Arkiv f. Zool., Stockholm, vol. 18A, no. 2, p. 12, 1925.
Felis sinensis Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 4, p. 4, 1930.

Type specimen:—The type specimen from "China" is still in the British Museum, No. 120a, a skin and skull sent (probably from Canton, Kwangtung) by J. R. Reeves.

Description:—The description of the color pattern given under the typical race applies equally to the Chinese subspecies, except that usually the ground color in the latter is grayer, often without any tinge of buffy, while the Indian animal is, more often at least, a decided ochraceous in its background. The color pattern is subject to wide variation in the particular tint of the background, and in the details of the spots, which may be enlarged to blotches, or more or less confluent to form broken stripes, while in their coloring there may be more or less ferruginous mixed with black to such extremes as figured in Milne-Edwards's plate of *F. microtis*, in which the spots seem to lack much black and are reddish or ferruginous instead. Apparently the markings are larger in males than in females, which are slightly inferior in size. Possibly, too, the differences may be similar to those seen in a number of spotted cats, in which there may be small-spotted and large-spotted individuals, independent it would seem, of other factors.

Measurements:—The field measurements of an adult male and a female from Wanhsien, Szechwan, were recorded by the collector (Dr. Walter Granger) as follows (those of the male first): head and body, 445, 485 mm.; tail, 230, 255; hind foot, 115, 114; ear, 45, 50.

CRANIAL MEASUREMENTS OF *FELIS BENGALENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Median length of nasals	Upper cheek teeth	Lower cheek teeth	Sex	Locality
F. bengalensis bengalensis											
43108	80.0	73.8	35.0	58.0	36.4	33.0	16.0	28.4	29.0	♀	Yunnan
F. bengalensis chinensis											
57375	93.0	87.0	40.0	72.3	40.2	36.5	22.0	28.8	33.5	♂	Fukien
60122	94.0	89.0	41.3	72.0	42.5	39.0	21.0	28.6	34.0	♂	Fukien
57376	87.0	81.5	37.8	62.6	38.0	34.0	22.0	29.0	32.8	♂	Hunan
84396	94.6	87.3	41.3	64.6	40.3	35.0	23.0	30.6	35.2	♂	Fukien
84399	86.3	81.0	36.5	64.5	36.5	35.0	20.0	28.2	32.3	♂	Fukien
F. ricketti, B M	105.0	88.0	39.0	69.0	——	——	——	——	——	—	Fukien
38333	82.0	75.5	35.5	59.0	36.0	33.2	16.6	27.7	——	♀	Kiangsu
57062	85.3	80.0	38.2	59.5	37.6	33.0	19.0	28.0	31.0	♀	Fukien
57065	89.5	83.0	37.3	63.0	41.0	37.6	19.8	31.4	33.0	?	Hopei
58371	79.5	74.5	35.5	57.0	34.5	33.3	17.0	27.8	29.6	♀	Szechwan
57119	82.5	76.0	37.0	56.2	37.0	33.3	19.0	29.4	31.0	♀	Hunan

CRANIAL MEASUREMENTS OF *FELIS BENGALENSIS* (Cont'd)

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Median length of nasals	Upper cheek teeth	Lower cheek teeth	Sex	Locality
				F. bengalensis chinensis							
57341	83.4	78.5	36.0	59.0	36.5	32.0	17.5	28.2	30.2	♀	Fukien
84397	83.5	77.0	36.8	60.0	36.5	33.6	17.0	28.0	29.3	♀	Fukien
84398	85.0	78.7	37.5	57.0	37.5	33.2	17.0	29.0	31.2	♀	Fukien
58376	78.5	71.6	35.0	53.0	35.8	33.0	18.0	27.3	29.5	♀	Szechwan
84395	85.0	80.0	37.0	57.4	36.8	33.0	16.7	28.0	——	—	Fukien
59961	84.2	79.0	36.5	57.0	36.6	32.7	18.5	28.5	31.2	♂	Hainan
59958	80.4	75.0	33.5	58.5	36.0	31.8	17.8	27.3	30.3	♂	Hainan
60054	83.2	77.3	34.5	63.0	38.0	34.5	17.8	28.0	30.4	♂	Hainan
60055	80.0	74.0	34.5	60.0	35.7	32.0	17.3	25.5	29.5	♂	Hainan
59957	83.0	77.0	34.3	58.5	37.0	32.5	18.0	28.0	30.0	♀	Hainan
59959	82.5	75.5	35.0	58.2	34.5	31.5	18.5	27.5	30.0	♀	Hainan
60093	77.0	70.8	31.8	55.0	35.0	31.2	15.0	25.4	28.3	♀	Hainan

The Hainan skulls may average very slightly smaller than those from the mainland. It is also noticeable in the latter that the nasals of males seem to be a trifle longer.

The skulls of adult males are a little larger than those of adult females, but the difference is not very great. In old males, too, the temporal ridges unite to form a sagittal crest, but none of the females that I have seen shows this development. There is often a complete orbital ring formed by the fusion of the postorbital with the jugal process, and frequently the contact is almost complete, so long is the postorbital point. Thus in an old female, No. 84397 (Fukien), the ring is complete on both sides; while in a second, No. 84395 (also from Fukien), the ring is complete on the left side only. In the presence or absence of the first upper small premolar, there is also a certain amount of variation. It may be absent on one or both sides in about fifty per cent of the specimens. The tooth is evidently deciduous in some cases, as attested by the partly filled alveolus. Of twenty-two skulls examined, the following showed this tooth missing:

No.	
57341	first premolar missing on both sides
57375	first premolar missing on both sides; old, no trace of alveoli
58371	first premolar missing on left side; alveolus filled in
59958	first premolar missing on right side
59957	first premolar missing on both sides
59959	first premolar missing on both sides
60055	first premolar missing on both sides
60093	first premolar missing on both sides
84395	first premolar missing on both sides; not old, no trace of alveoli
84396	first premolar missing on left side; no trace of alveolus
84399	first premolar missing on both sides; alveoli partly filled in

The large upper carnassial often has the antero-internal cusp or lobe very poorly developed, occasionally almost obsolete. Lönnberg mentions that it is lacking in a skull he examined from Kansu.

Nomenclature:—Obviously the common Tiger Cat of China is very similar to the Indian *F. bengalensis*, indeed, hardly more than a poorly marked subspecies. Jacobi (1922), however, seems to have been the first to use the name in trinomial form. Cabrera, indeed, has suggested that *Felis pardella* of Pallas, a name long overlooked, based on a spotted cat from China, should be used instead of *F. chinensis*, in which case, dating from 1784, it would also antedate *F. bengalensis*, the latter then becoming a subspecies. However, it seems unwise to upset long usage by introducing a name that is not certainly identifiable. Various names have been from time to time bestowed upon Chinese cats of this type, all apparently based on variations of color or details of markings. The material examined in the collections of the American Museum of Natural History and elsewhere, however, does not seem to me satisfactorily divisable into more than the two races. Hainan skulls, as shown by the measurements in the adjoined table, average a very little smaller than those of mainland animals, but the differences are insignificant and the color characters are the same. Probably the cats of North China will eventually prove to have slightly thicker winter pelage, and other characters may be found to warrant their subspecific separation, but at present no clearly definable characters appear. Elliot described as *Felis euptilura* a cat of this type, said to have come from Siberia, and considered Milne-Edwards's *Felis microtis* of the vicinity of Peiping as the same. He examined the type of the latter and found that its ears were of normal length, instead of smaller as its describer supposed; indeed, he inadvertently spells the name *F. macrotis* in his "Monograph of the Felidæ." Undoubtedly, as Elliot says, Milne-Edwards's *Felis decolorata* is the same as his *F. microtis*, the former based on a skin sent from Peiping by Fontanier, the measurements of which (head and body, 830 mm., tail, 320) are indeed large, but evidently the specimen was a native skin and unduly stretched. Elliot was unable to detect any difference between his *F. euptilura* and Milne-Edwards's *F. microtis*, the type of which he again figures, an animal in a reddish phase of coloring. Apparently Milne-Edwards's *Felis scripta* is really quite the same, with a yellowish ground color but the essential markings of *F. b. chinensis*, nor can I see, after a careful perusal of the descriptions and an examination of the type specimens, that Bonhote's *F. ingrami* and *F. ricketti* are really different. The former is based on a skin without skull from northern Kweichow, and was perhaps a young animal, at all events short-tailed if the condition of the specimen can be assumed to be good, and with broad spots and markings. It is, however, clearly *F. b. chinensis*. The *F. ricketti*, from Foochow, Fukien, was believed to differ from *F. b.*

chinensis in its larger size and gray ground color. The sex is not stated, but was probably male, and the skull length as given, 105 mm., is unquestionably large, but the basal and palatal lengths and the zygomatic width are quite those of males of *F. b. chinensis*. Bonhote apparently had not a sufficient series to prove that the gray and the buff-colored specimens are only individual variations, so that, to clinch the matter, the statement of Sowerby (1923g, p. 37), may be cited, that of two kittens which he bought "from a native at Chin-wang Tao, close to the Sino-Manchurian border, and which were obviously of the same litter, one was dark like my Tung Ling specimen, and the other was light (buff-yellow or sandy)." He adds, in commenting on *F. euptilura* and *F. chinensis*, that probably "the two names represent but the one form." The Siberian, typical *F. euptilura*, however, may very likely prove to be a distinct subspecies. Satunin's *Felis anastasiæ* seems likewise to be a synonym. It was described from a series of five specimens coming from Kam (Tibet), Kansu, and northwestern Szechwan, and is admitted to be similar to *F. bengalensis* and *F. scripta*, but no specimens of these were available for comparison. More recently, however, Lönnberg (1925) has figured a specimen from Kansu which apparently agrees with *F. anastasiæ*, and there is no doubt but that the two are both *F. b. chinensis*, as that author himself seems ready to concede.

Occurrence and Habits:—The Tiger Cat is very widespread in eastern Asia, going with very little appreciable change from India to the Amur region. It is found throughout China, except in the really desert areas, and appears to thrive even in rather thickly settled districts. Mr. Clifford H. Pope writes that in Fukien it is known as "chin ch'ien mao" or Money Cat, in reference doubtless to its many spots, like Chinese cash. Its flesh is much prized by the natives as an article of diet. He found it common on Hainan, haunting thickets, and occasionally coming about the Mission compound at night for chickens. Swinhoe (1870c, p. 629) regarded it as the commonest wild cat in Formosa and South China, where it is a forest-dwelling species. He mentions skins in the British Museum sent by Reeves from Canton, and others from Shanghai and Fukien. Milne-Edwards was unable to detect any difference between a skin from Canton and another from the mouth of the Pei Ho, Hopei, notwithstanding that he considers another specimen from Peiping a different species, *F. microtis*. In northern China it becomes less common on the southern edge of the Ordos and Gobi Deserts. Sowerby, however, trapped a male at Yenanfu, Shensi, that was raiding a chicken coop, and Thomas (1911e) has recorded (as *F. microtis*) one from thirty miles south of Fengsiangfu, southern Shensi. It occurs in the forests at the Eastern Tombs, Hopei, whence both Sowerby and Dr. R. C. Andrews have obtained it. The former also mentions one killed by dogs in the Shanghai district in 1924. The westward

and altitudinal limits of the range are perhaps coëxtensive with forests and thickets. Under various synonyms, it is recorded from the Principality of Muping, and from southern and western Kansu (Ssigu), while the Russian explorers have brought back skins from the borders of eastern Tibet (Kam). Of its habits little has been written, except that it haunts thickets, and often raids the henyards. Mell (1922) says that in winter it is occasionally brought in alive to the animal market at Canton, but seems always wild and untamable, yet taken as a kitten, the case might be different, for Pope had a little one that was very friendly and continually followed people about. Unfortunately it died after about two weeks, having developed bowel trouble. The only records of young found in China seem to indicate small litters. One of three was brought to Mell (1922) on May 29 at Logong, Kwangtung. They were found under a boulder in bush jungle and were judged to be about two weeks old. He mentions that their growth in captivity seems very slow, for two sucklings brought him on May 24 were still very small in December. Sowerby, as already noted, had a litter of two kittens offered him for sale near the Sino-Manchurian border. A much earlier breeding date is indicated for Hainan, where, at Nodoa, three small kittens were obtained by Mr. Pope in very late March (26-28).

Specimens examined:—The following are referred to this race, in all fifty-six:

"China," 4, including the type (B.M.).
Kiangsu: Chinkiang, 1, +1 (B.M.); Shanghai, 1 (B.M.).
Chekiang: Ningpo, 1 (B.M.).
Hopei: Peiping, 1; Eastern Tombs, 1.
Hunan: Yochow, 5.
Hupeh: Changyanghsien, 1 (M.C.Z.); Shanyang, 1 (B.M.).
Kweichow: Vingin Shan, 1 (B.M.), type of *F. ingrami*.
Fukien: Futsing, 7; Chunganhsien, 2; Yenping, 5; Foochow, 1 (B.M.), type of *F. ricketti*.
Szechwan: Suifu, 1 (M.C.Z.); Wanhsien, 3.
Hainan: Nodoa, 15; Namfong, 1; Mount Wuchih, 2 (B.M.).
North China, 1.

Subgenus **Profelis** Severtzov

Profelis Severtzov, Rev. et Mag. de Zool., ser. 2, vol. 10, p. 386, 1858. Pocock, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 340, 1917.
Chrysailurus Severtzov, Rev. et Mag. de Zool., ser. 2, vol. 10, p. 389, 1858.
Catopuma Severtzov, *ibid.*, p. 387.
Pyrofelis Gray, Ann. Mag. Nat. Hist., ser. 4, vol. 14, p. 354, 1874.

This subgenus includes Temminck's Cat of eastern Asia and the Golden Cat (*Felis aurata*) of the western part of Africa. Both agree in showing a marked dimorphism in pattern. The two first names given in the synonymy above have the African animal as type; the two latter were based on the

Asiatic cat. Pocock (1917) regards these as representing but a single group, and gives preference to the first name. The characters given are, in addition to the type of coloring: the long cylindrical tail, differing in color on the top and ventral sides; the larger size of skull, in which the distance from orbit to gnathion exceeds the long diameter of the orbit; the relatively short post-orbital processes; the well-developed lateral flange along the side of the pterygoid bone; the broad nasals, which though of depressed form, not everted at the tips, differ from those of *Prionailurus* in having a median pit at their proximal end in the frontal bone. The ascending processes of the maxillary, instead of being nearly vertical in direction and bluntly rounded off, taper slightly with a posterior turn. The first small upper premolar is frequently lacking. Only one species occurs in Indo-Malaysia and China, and, although names have been given to various supposed races, it seems doubtful if more than the one occurs in the latter country. It was at one time supposed that the relationships of this subgenus were close to the American puma, but this appears not to be the case.

209. **Felis temminckii tristis** Milne-Edwards

Felis tristis Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 223, pl. 31D, 1868-74 (1872).
Felis moormensis Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 2, p. 180, 1896 (?not of Hodgson).
Felis moormensis nigrescens Pousargues, *loc. cit.* (?not of Gray).
Felis dominicanorum P. L. Sclater, Proc. Zool. Soc. London, 1898, p. 2, pl. 1.
Felis semenovi Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1904, vol. 9, p. 524, 1905.
Felis temminckii mitchelli Lydekker, Proc. Zool. Soc. London, 1908, p. 433.
Felis (Catopuma) melli Matschie, in Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 36, 1922 (not *Felis (Neofelis) melli* Matschie, *ibid.*, p. 35).
Felis temminckii bainsei Sowerby, China Journ. Sci. and Arts, vol. 2, p. 352, 1924 (*lapsus calami*).
Felis temminckii bainesi Sowerby, *loc. cit.*
Felis temminckii badiodorsalis A. B. Howell, Proc. Biol. Soc. Washington, vol. 39, p. 143, 1926 (new name for *Felis (Catopuma) melli*).
Felis temmincki dominicorum A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 33, 1929.

Type specimen:—The type is a skin without skull, representing the phase with striped pattern, bought in Peiping by Fontanier, and sent to the Muséum d'Histoire Naturelle at Paris, where it presumably still is. The exact locality whence it came is unknown, but it was said to have been procured in the interior of China.

Description:—In its coloration this cat shows an extraordinary dichromatism, somewhat comparable to that exhibited by its African relative, of the same subgenus, *F. aurata*. The more usual type of coloring is that in which the central area of the occiput, neck and back are bright ferruginous, more or less darkened by black or black-tipped hairs; the sides of the neck, body and proximal portions of the limbs are rather abruptly paler, nearly cinnamon, the individual longer hairs having a pale-gray basal three-fourths, then a

narrow ring of blackish brown, succeeded by one of cinnamon, and often tipped with black; a number of white-tipped hairs among these contribute to give a pale effect to the sides of the body. The fore and hind feet are grayish, the short hairs covering them having a pale basal portion, then a narrow blackish ring, and a gray tip; a short blackish stripe marks the outer edge of the sole of both fore and hind paws. The head in this phase is the only part of the body showing definite pattern: there is a conspicuous short white stripe at the inner corner of each eye, running vertically for about 20 mm.; the upper point of each is nearly continuous with a longer grayish-buff stripe on each side passing on to the occiput; this stripe is bordered above and below by a very narrow black line, the outer one of which arises above the center of the eye; a broad white stripe commences about a centimeter below the middle of the eye and passes back to the level of the ear; below this is a blackish stripe, with a narrower broken stripe or double series of spots along the upper lip; chin and upper throat and the lips at the tip of the muzzle white. Backs of ears black, with an indistinct gray area in the middle; a clear gray area about their bases. Lower throat with a transverse blackish bar bordered with rusty; upper chest with small irregular rusty spots, which on the lower chest and ventral surface of body become larger, more definite blackish spots, surrounded by cinnamon hair, and arranged in about half a dozen transverse series. Inguinal region and under side of the tail to its tip white; dorsal side of the tail like the back and sides, gradually darkening in the terminal part, becoming less chestnut, then blackish, and finally with a black tip about 70 mm. long. Occasional individuals vary from this type of coloring through being less clear reddish in the mid-dorsal region, but instead are a dark brown all over the back; it was apparently such an animal that served for the original of Elliot's plate in the "Monograph of the Felidæ," and is possibly that named *Felis moormensis nigrescens* by Hodgson. This condition may be still further accentuated and a nearly black condition result, to which Hodgson gave the name *niger*.

The second type of coloration, instead of having the body of an almost uniform tone, has a handsome pattern of spots and stripes that very much resembles the pattern of *Felis bengalensis*, so that animals in this phase have usually been regarded as representing a separate species. In most cases apparently, this phase agrees, nevertheless, with the monochrome type in having the ears black with a grizzled central area on the back, a clear gray patch behind each ear, with the same bright ferruginous nape and shoulders. The pattern in the one secured by Pope in Kuatun has the head markings as in the usual type, but in addition there are two narrow lines of black down the back with a less clearly marked pair external to them, then about four rows on each side, of elongate blotches and spots, each with an ochraceous center

incompletely ringed by a broken blackish margin, usually wider at the posterior side. A row of blackish spots is present on each side of the belly. The tail, in addition to the usual coloring of ferruginous above and white below, with a black tip, has also about fifteen black bars along its length as in the smaller species mentioned. This striped phase seems also subject to a certain amount of individual variation in the general tone, some specimens being more ferruginous as in the one described, others duller and browner, apparently like the specimen figured by Milne-Edwards as the type of his *Felis tristis*. The meaning of this dichromatism is not altogether clear, but the striped phase may represent a primitive pattern not yet altogether lost in evolutionary progress. It would be interesting to know if the young have it.

In males, the temporal ridges of the skull unite to form a sagittal crest when adult, but in both female skulls seen, these ridges make a large lyrate outline, and probably do not form a crest except posteriorly. In five skulls the small upper anterior premolar is present on both sides in but one, in two others on the right side only, while in the other two it is lacking on both sides.

Measurements:—The dimensions of the type skin of *F. t. tristis* as given by Milne-Edwards are: head and body, 840 mm.; tail, 400, but no doubt the hide had been stretched in preparation. The two native-cured hides that served Satunin as types of his *F. semenovi* measured, the male and female respectively, head and body, 1050, 940 mm.; tail, 560, 490. A female in the striped phase, from Fukien, measured by Mr. C. H. Pope as follows: head and body, 731 mm.; tail, 485; hind foot, 174; ear, 67.

CRANIAL MEASUREMENTS OF *FELIS TEMMINCKII TRISTIS*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Mas-toid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Length of nasals	Sex	Locality
84392	122	113.0	52.0	85.0	58.5	47.0	42.7	49.0	29.0	Im.♂	Fukien
84393	119	111.0	51.7	83.0	56.5	49.3	43.3	48.5	27.0	Im.♂	Fukien
84396	136	126.5	60.0	98.0	61.0	51.0	48.3	53.0	31.4	Ad.♂	Fukien
84394	119	109.0	52.5	78.0	51.5	47.0	44.0	47.4	29.0	♀	Fukien
84395	108	98.0	46.0	75.5	48.3	45.5	39.0	42.0	25.4	Im.♀	Fukien

Nomenclature:—The proper subspecific name for the Chinese race of Temminck's Cat is not easily determined. Typical *F. temminckii* was described from Java, and it is assumed that the continental representative is at least subspecifically different. The first name applied to a continental animal was *F. moormensis* of Hodgson, 1831, which with Gray's *F. nigrescens*, 1863, applied to the Nepalese form. It is assumed that the Chinese representative is different still, since Nepalese races of other species are frequently darker. If this prove not to be the case, Hodgson's name would be the subspecific title, but if the animal of China is really different, the earliest name applicable

to it seems to be *Felis tristis* of Milne-Edwards, 1872, the striped phase of the same cat. The type skin as represented is rather gray in tone of the ground color, which led Satunin in 1905 to propose the name *Felis semenovi*, based on two skins, one in the striped, one in the monochrome phase, purchased in the fur market at Sungpan, northwestern Szechwan. He seems to have been the first definitely to recognize that the two phases represented one and the same species, although Pousargues (1896a) seems also to have suspected this. Lydekker, in 1908, seems to have been the first to make comparison of western Chinese skins with those from Nepal and Sikkim, representing Hodgson's *F. moormensis*. He concluded that the specimen he had, a tanned skin only, from Szechwan, representing the monochrome phase, was subspecifically different from the latter, and named it *Felis temminckii mitchelli;* it is characterized by lighter upper parts, which are golden tawny, with a narrow light-rufous dorsal streak, instead of being mahogany brown. He adds that Sikkim and Nepal specimens show a bright rufous phase with pale and spotted underparts, as well as a wholly dark reddish-brown phase. This latter phase, however, may occur in China as well, for the specimen represented by Sclater's plate of his *Felis dominicanorum*, seems to be of this variety. The name, nevertheless, may prove to be available if the Temminck's Cat of eastern China is really separable from that of western China. Apparently, too, Sowerby's *Felis temminckii bainesi*, based on a skin from Tengyueh, western Yunnan, is nothing less than this same dark-brown variant. Matschie, in 1922, added to the difficulty by naming as *Felis melli* two skins from Weisi in western Yunnan, pointing out that they differed from *F. t. mitchelli* in minor details of color that are undoubtedly matters of individual variation. This name, however, he had in the same paper given to a supposed new Clouded Leopard, so A. B. Howell proposed in its place the name *Felis t. badiodorsalis*.

In spite of all these names, it seems to be the case that the dark and lighter variants of the species occur throughout the range in China, as well as monochrome and striped individuals, so that for the present it does not seem possible to recognize more than the one race in this wide range, with the possibility that the more southern or southeastern animals will be found eventually to constitute a recognizable subspecies, *F. t. dominicanorum*.

Occurrence and Habits:—As already indicated, the Chinese race of Temminck's Cat is at present known from the low country of southeastern China as far north as northern Fukien, westward in forested areas to the highlands of Szechwan and Yunnan. Skins of this cat are apparently traded about a good deal, especially those of the striped phase. It was one of these, bought at Peiping, that served as the type of *F. tristis*, and of two others purchased at Sungpan that Satunin described as *F. semenovi*, one was striped, one un-

striped. Mell (1922) mentions one of the former type bought in Yunnanfu, said to be from the region between Tali and Likiang, and Pousargues (1896a, p. 3) records one brought back by Prince Henri d'Orléans from Yunnan, and others sent by the missionaries from Tatsienlu, Szechwan. The most northerly record is that by Buechner, of a specimen secured by Berezovski in the region of Ssigu, Kansu, though if this were a trade skin, there may be some doubt as to its having come from near by. Shih (1930b, p. 2) notes it from the southwestern border of Hunan. Menegaux (1905, p. 72) writes that its distribution is from Nepal east to Szechwan and south over the whole Indo-China peninsula. He states that a skin from Tongking is indistinguishable from one from "Tibet," and mentions one sent by Gaston Péronne from Atuntze, northwestern Yunnan (where he stayed two months), at 3,170 meters altitude. At Likiang, Péronne said, they were common and he often saw them. The Paris Museum also has a skin sent by Fontanier from China in 1867 that appears to be "la forme mélanique" mentioned by Hodgson. Pousargues (1896a) records two skins brought back by Prince Henri d'Orléans from Yunnan, one of which had the body a uniform brown, the other blackish with red between the shoulders. Both showed the usual facial markings. In eastern China, this cat seems to be less common, most of the specimens coming from Fukien. Sclater's type of *Felis dominicanorum* was obtained at Kuatun in that province in 1897, by some Dominican monks, of whom it was received by Rickett and La Touche and sent by them to the Zoölogical Gardens at London, where it lived until the following year. Mr. Clifford H. Pope secured no fewer than five beautiful specimens at Chunganhsien, northwestern Fukien, which are practically topotypes of *F. dominicanorum*. Of these, only one represents the patterned phase. He writes that it is the common cat in the vicinity of Kuatun and is trapped by hunters who set steel-toothed traps with bamboo springs along paths cut through the forest; hence the species must range generally over the higher mountains. It was not heard of in Futsing. The Chinese call it "huang pao" (Yellow Leopard) or "shih hu" (Rock Cat), and its bones bring a good price in native medicine shops at near-by market towns. Williston (1926) has described an animal, evidently this, called by the Chinese "Yellow Leopard," brought in to him at Longanfu, western Szechwan.

It would be interesting to know the significance of the alternative types of pattern and whether they bear a Mendelian relation to each other. The 1:4 ratio of the Pope series is suggestive of something of the sort.

Specimens examined:—Five, from Chunganhsien, Fukien.

Subgenus **Neofelis** Gray

Neofelis Gray, Proc. Zool. Soc. London, 1867, p. 265.

This subgenus includes the Clouded Leopard, ranging from the eastern Himalayas to Borneo, and in China to Fukien and Hainan. Characteristic are the beautifully patterned markings of the body, consisting of large areas of the buffy-gray background marked off by black, the rather long, dark-ringed tail, the relatively short ears. Pocock (1917) states that the feet and rhinarium scarcely differ from those of the larger felines that he includes in *Panthera*. He also briefly sets forth the salient features of the skull, as compared with those of a leopard. In size the skull resembles that of a small leopard in the short and widely separated postorbital processes which do not closely approximate the corresponding processes of the jugal bone; the lower edge of the orbit is distinctly thickened; the nasals are broad; the mandible is so elevated anteriorly that the symphysis is nearly vertical; and the canines are remarkable for their relatively great length. Pocock states also that the occipital area is remarkably triangular and pointed, and the bony partition in the audital bulla low as in other forest-living species. The tooth formula is as in typical *Felis*.

The type species is *Felis nebulosa*, of which other described forms, if valid, are doubtless best considered as subspecies.

210. **Felis nebulosa** Griffith

CLOUDED LEOPARD

Felis nebulosa Griffith, Descrip. Vertebr., p. 37, 1821.
Felis macrocelis Swinhoe, Proc. Zool. Soc. London, 1870, p. 228.
Felis (Neofelis) melli Matschie, in Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 35, 1922.

Type specimen:—The type specimen of Griffith's *Felis nebulosa* was believed to have come from Canton, Kwangtung, China. It is probably no longer in existence.

Description:—The general ground color of the dorsal surfaces is a grayish buff, the hairs brownish at the base tipped with buffy, and mixed with a sufficient number of similar but black-tipped hairs to darken the effect slightly. On this ground the head shows more or less of the usual cat pattern. The eye is narrowly ringed with black except at the upper anterior corner; this ring is prolonged forward as a short dark marking, separating a short whitish stripe above the eye from the similar one below it. Posteriorly the black eye-ring continues as a black stripe across the cheek, while below it, commencing about 40 mm. behind the angle of the jaw, a second black stripe runs backward along the side of the neck, separating the buffy gray of the dorsal side from the white of the throat. Anteriorly this stripe expands and becomes nearly transverse, but the two stripes of opposite sides do not quite meet in

the skin described. At the base of the mustachial vibrissæ are three or four parallel rows of small spots, and the posterior half of the upper lip is black. The muzzle and space between the eyes are unmarked, but the forehead and occiput are spotted with black. The backs of the ears are also black, with a slightly marked pale-gray area about half-way up. Six black stripes mark the back of the neck: the innermost pair starts low on the back of the head and runs to the upper base of the neck; the second pair starts one on each side between the midline and the base of the ear; the third pair begins, one from the base of each ear. All three pairs end at the fore shoulder, the second the widest, and more or less continued down the back as a double series of elongate black blotches, which across the rump again become definitely two narrow black stripes, to the base of the tail, and may even be traced in more or less broken form, out on to the basal half of the tail. The sides of the body and the haunches are marked with the characteristic pattern of the species, consisting of about six transverse blotches on each side, outlined in black, the posterior blotch more or less subdivided into rows of three. These transverse patches or smaller blotches have the narrow black border best developed on their posterior side, and it may be more or less imperfect on the anterior side. Usually there are a few small blackish dots scattered inside these ringed areas. Tail with its mid-dorsal area near the base buffy, with the two blackish median stripes of the back traceable for a varying distance on it. Otherwise the tail-pattern consists of about fifteen indistinct blackish to brownish rings alternating with grayish-white rings. The lower side of the body from chin to anal region is white with about four rows of blackish-brown spots or blotches across the chest and belly, and smaller scattered spots of the same on the inner sides of the limbs.

The peculiarities of the skull have been mentioned among the subgeneric characters.

Measurements:—None available.

Nomenclature:—Griffith's type locality may be fixed as Canton, China, or that neighborhood, so that, taking into account the individual variation in pattern of markings shown by cats, there is no reason to suppose that Matschie's *Felis* (*Neofelis*) *melli*, based on a specimen killed a three-hours' journey northwest of Lienping, near Canton, is really a different race. The chief difference mentioned by its describer is the fewness and relative breadth of the dark tail-rings. Swinhoe, using Horsfield's name, *Felis macrocelis*, for the Chinese animal, says it is called in Chinese the Mint Leopard, on account of the shape of its blotches, recalling mint leaves, in distinction from the Common Leopard, whose spots, shaped like cash, have earned for it the name Golden Cash Leopard. The type locality of *Felis macrocelis* is Sumatra.

This name, published in 1825, four years later than *F. nebulosa*, is usually regarded as synonymous with the latter, but very likely the two are subspecifically distinct, a suggestion made as long ago as 1827 by Griffith himself (in the "Animal Kingdom by Cuvier," vol. 5, p. 164).

Occurrence and Habits:—Very little seems to be known concerning the Clouded Leopard in China. The Central Asiatic Expeditions apparently did not encounter it alive, but secured two native-made skins, one at Yenping, Fukien, and one at Namfong, Hainan. On the latter island, Swinhoe (1870a) wrote that it was said to occur in the mountains with the common leopard. A. B. Howell (1929) also records a hunter's skin from Kachek, Hainan. Trouessart and Kollman (1914) mention a skin sent among others from Kweichow by a missionary who secured it at Sanchouenfu, an important fur center. There is of course no certainty that it was locally obtained. Mell (1922) writes that skins he purchased in the fur market at Canton were said to have come from Kwangtung and Kwangsi, but he believed that they had been obtained even farther west, and had seen one freshly killed, three hours' journey west of Missionary Weller's home at Lienping, and he later bought in Canton a native-prepared skin said to have come from the same region.

Present evidence seems to indicate that it occurs sparingly throughout southeastern China as far north as Fukien, but hitherto no record of it seems to have appeared from southwestern parts of the country.

Specimens examined:—Two skins without skulls, namely:

Fukien: Yenping, 1.
Hainan: Namfong, 1.

Subgenus **Panthera** Oken

Panthera Oken, Lehrbuch d. Naturgesch., vol. 3, pt. 2, p. 1052, 1816.

Pocock (1917) would separate the larger cats, in which the suspensorium of the hyoid apparatus is imperfectly ossified, from the smaller species, in which that portion is bony, to form a separate subfamily, Pantherinæ. In this group he includes but two genera: *Panthera* for the leopards, jaguars, lions and tigers, and *Uncia* for the snow leopard, characterized by its peculiar, abrupt profile. Severtzov (1858), basing his classification on less sound characters, included in *Panthera* not only the leopards and jaguars of the above list but also the Snow Leopard and the American Puma, placing the lion and the tiger as separate subgenera of the genus *Tigris*. J. A. Allen regarded *Leo* as a distinct genus for the lion, and restricted *Panthera* to the leopard and jaguar, species that are very closely related. It is evident that uniformity in usage is still to be attained, and no doubt the scheme of designating each species-group, as lions, tigers, leopards, etc., as a genus will be the outcome for those who wish to emphasize these group differences. On the other

hand, these characters may be equally well emphasized by the use of subgenera and thus at the same time imply the rather close relationship. It is remarkable, as Pocock points out, how difficult it is to find differences of a kind that will distinguish the skulls of lions, leopards, and tigers, yet each type of animal has its specialized coat-coloring and different habits, evolved along highly contrasted lines.

In the subgenus *Panthera*, using that term to include leopards and tigers among Chinese species, the muzzle is relatively long compared with the length of the skull, the distance from orbit to gnathion far exceeding the long diameter of the eye instead of being less, and indeed about equals one-fourth the total length of the skull. The ascending branch of the maxillary tapers away posteriorly, instead of being carried vertically upward as in the short-nosed forms, so that in the latter it encroaches upon the middle of the nasals, producing a pinching-in, whereas in *Panthera* and other large cats, the nasals are broad and taper only very slightly and gradually toward their proximal tip, where they end in a slight depression. *Panthera*, as used by Pocock, includes the leopards and tigers; some, however, would, with almost equal propriety, regard the latter as constituting a separate genus, *Tigris*, characterized by its color pattern and slight differences in proportion of the cranial bones. The name *Panthera* was used in the same year, 1816, by Oken for the leopard and by Hübner for a genus of insects, but at the present time, precedence is tacitly given to its use for the mammal.

211. **Felis pardus fusca** F. A. A. Meyer

INDIAN PANTHER OR LEOPARD

Felis fusca F. A. A. Meyer, Zool. Annalen, for 1793, vol. 1, p. 394, 1794.
Leopardus reevesii Gray, List Mamm. Brit. Mus., p. 44, 1843 (?nomen nudum).
Leopardus perniger Hodgson, in Gray, Cat. Mamm. Nepal and Thibet, ed. 2, p. 3, 1863.
Felis pardus Swinhoe, Proc. Zool. Soc. London, 1870, p. 628.
Felis pardus var. *melas* Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 2, no. 5, p. 180, 1896.
Felis pardus sinensis Brass, Nutzbare Tiere Ostasiens, Neudamm, p. 6, 1904.
Felis pardus ?chinensis Hilzheimer, Abh. u. Ber. Mus. f. Natur- u. Heimatk., Magdeburg, vol. 1, p. 183, 1906.
Felis pardus variegata G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 235, 1912.
Leopardus pardalis sinensis Mell, Arch. f. Naturgesch., vol. 88, sect. A, pt. 10, p. 18, 1922.
Felis pardus perniger G. M. Allen, Amer. Mus. Novitates, no. 360, p. 12, 1929.
Panthera pardus fusca Pocock, Journ. Bombay Nat. Hist. Soc., vol. 34, p. 307, 1930.

Type specimen:—Not known to be in existence. Meyer's name and description were based on a melanistic example of the Indian Leopard from Bengal. His account in turn was taken from a notice of the animal published by de la Methérie, who saw the animal in captivity in the Tower of London. The name appears to be the first given to the leopard of eastern India.

Description:—In the leopard, the common cat-pattern of stripes and blotches is still further fragmented, so that the markings consist of numerous rounded spots on a bright ochraceous-buff ground. On the head, these

spots are small and more or less rounded with a distinct tendency to arrange themselves in longitudinal lines, corresponding to the lines on the sides of the cheeks and down the back of the head and neck of many other cats. The middle of the nose alone is clear, or rarely with a few minute black dots, and there is a trace of the pale line at the inner canthus of the eye, of a slightly more whitish tint than the rest of the head. On the body the ochraceous tint becomes deeper along the median line, paling to ochraceous buff on the sides. The black spots become larger, and on the median line form a nearly continuous row of elongate black blotches. Laterally the spots take on the form of rings, that may be complete, or broken on the posterior side, less often the anterior, and may have a clear ochraceous-buff center, or this may contain a central black dot. On the flanks and belly, as well as on the outer sides of the legs, the markings again become solid black blotches of varying rounded shapes. There are about half a dozen series or transverse rows across the belly, and the inner sides of the limbs have also numerous but less regular scattered black spots; elsewhere the under surfaces of body and limbs are white. The long tail on its basal half has the median dorsal area ochraceous like the back, with a double row of elongate black spots, while terminally and below, the areas between spots are white, and the spots tend to form more or less distinct broad transverse rings with narrow white areas between, and a black tip.

As pointed out by Pocock and others, the skull is in its general shape and proportions much like the tiger's or lion's, and differs from that of the smaller cats in the greater relative length of the rostrum, which is much less abruptly curved downward, so that the nasal bones are not narrowed by the ascending branch of the maxillary, and the distance from orbit to gnathion exceeds the long diameter of the eye instead of being less. In general it is true that when a leopard's skull with the jaw in place is laid on a flat surface, the hinder portion of the cranium rests upon the surface, but in the tiger it does not, and that the outline of the lower border of the mandible is more nearly straight, whereas in the tiger it is somewhat concave from below. These distinctions, as Pocock has shown, however, do not in every case hold true. The nasals only slightly exceed in backward extent the tips of the ascending processes of the premaxillary, which are produced backward, slightly tapering and truncate at the tips, in contrast to their more nearly vertical position in many of the smaller cats.

Measurements:—A fine adult male leopard shot in Hupeh by the late W. R. Zappey, measured in the flesh as follows: total length, 2,080 mm.; tail, 850; hind foot, 260; height at the shoulder, 610; height at the hip, 605. Females are smaller.

CRANIAL MEASUREMENTS OF CHINESE LEOPARDS

No.	Greatest length	Condylo-basal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
57008	210	190	174	90	129.0	87.0	76	69.5	80	Ad.♂	Szechwan
60163	207	193	178	89	137.5	89.0	74	66.5	75	♂	Fukien
60106	193	174	160	85	123.0	86.5	75	65.0	73	♂	Shensi
7891 MCZ	223	201	189	97	149.0	91.0	76	69.0	81	Ad.♂	Hupeh
43091	180	—	—	85	116.0	77.5	69	60.0	66	♀	Fukien
12720 MCZ	199	180	165	85	126.0	78.5	72	64.0	72	♀	Hupeh

Nomenclature:—The question of the correct name for the leopard of southern China is not easily settled. Pocock has lately reviewed the group on the basis of available material in the great collections of the British Museum, but this attempt has only revealed how imperfect and insufficient is the basis for many of the names used. The type locality of *Felis pardus* of Linnæus, in spite of doubts that have been raised as to some of the points involved, is now regarded as North Africa, probably Egypt. Three geographical races intervene before the form of the Indian lowlands is reached, for which the earliest name seems to be, as Pocock was the first to show, the *Felis fusca* of Meyer, based on a specimen at one time in the menagerie of the Tower of London, from Bengal. It seems likely that this is the form of leopard that is found to the eastward across the southern part of China, but without adequate comparisons this is difficult to be certain of. Hodgson in 1863 used the name *Leopardus perniger* for a melanistic leopard from Nepal, but, as Pocock shows, this is probably not applicable for a recognized race. In 1912 I used the name *F. p. variegata* for the Chinese Leopard, but the basis of this is a Javanese leopard, as is also the earlier *F. p. melas*. This animal is regarded as subspecifically different by Pocock. Brass, in 1904, gave the name *sinensis* to a Chinese leopard in a treatise on furbearers, but the name is hardly worthy of consideration, being unidentifiable. Provisionally, therefore, the leopard of southern China may be considered the same as the leopard of eastern India. Dr. E. Schwarz, who has seen many leopard skins, writes me that "there can be no doubt that Malay specimens are entirely different from the Indian ones. The North Chinese animal is also different enough to deserve a name."

Occurrence and Habits:—Leopards are still fairly common over southern China where vegetation and forest cover are not so cleared away as to offer no concealment and shelter. E. H. Wilson (1913) writes that in western Szechwan, leopards are scarce north of Maochow, but are of general occurrence from Mount Omei southward into Yunnan. They are plentiful also to the eastward in brush-clad rocky country. The specimen secured by Zappey at the head of Ichang Gorge was purchased from some natives who had caught it in

a bamboo-noose trap, though usually log traps are used. Wilson further relates that on one occasion while descending the valley of the upper Min River, in western Szechwan, he met three men laden with more than a hundred leopard skins. These they said came from Kweichow and Yunnan, and were being taken to Sungpan from Suifu to be used for robes and girdles by the Sifan and other tribesfolk. Mr. Clifford H. Pope, who collected several specimens in Fukien, writes me that the leopard is common in Futsinghsien where it is bold and daring, often attacking cows and goats near villages in broad daylight. At Kuatun, in the northwestern part of the province, the hunters maintained that it was not uncommon in the lower country but avoided the higher levels, where Temminck's Cat is the commoner species. The familiarity of the leopard in southern China is well illustrated by Professor C. R. Kellogg's (1927) account of two grown cubs with their mother appearing on the campus of Fukien Christian University. In 1905, a female from Hongkong was presented to the Zoölogical Society of London. Swinhoe (1870c) was familiar with the leopard in South China, and believed that skins from the Canton Market were a much richer yellow with larger black spots than those from India.

Relatively little is written about the intimate habits of the leopard in China. The number of young is probably small. Two were with the adult mentioned above, and Count Gyldenstolpe has recorded two fetuses in a female killed in Siam. Two fetuses were found in a female killed at Yenping, Fukien, January 26, 1920. Mell (1922), who resided for several years in southern Kwangtung, says that they are uncommon there and he had known of but one, taken at Lofau; in the more northern mountainous parts of the province, however, they were everywhere occasional. He saw freshly killed ones at Jannfah River and Lihnshan. At the latter village, a very bold leopard came in through the open window of his house and carried off one by one his three dogs, while he slept. They were kept tied to his bed at night. The first dog was taken on a Tuesday night, the second on Wednesday, and the third at about 3 in the morning of Friday, notwithstanding that on Thursday night when a watch was kept for it, it escaped. A few days later the same animal carried off a pig from a village a few miles away. A hunt was organized by the villagers, and the leopard was at length surrounded and dispatched with rifles and axes, although not before two men and a woman had been wounded by the animal. Sowerby (1925c) speaks of a man-eating leopard killed near Huchow, Chekiang, but it must be rarely that they regularly take to a diet of human flesh. Black or melanistic individuals are apparently not uncommon in parts of southwestern China, and especially in the Malay Peninsula. Hodgson secured examples in Nepal, Anderson (1879) also obtained two black leopard skins at Tengyueh, western Yunnan, and Mell (1922)

states that he saw very large dark skins from the Jannfah region, in Kwangtung.

Specimens examined:—In all, fifteen, as follows:

Fukien: Futsing, 5 (four skins, two with skulls, and a skull without skin); Yenping, 2 (one without skull).

Hupeh: Changyanghsien, 1; Ichang, 1 (M.C.Z.).

Szechwan: Wanhsien, 1; Tatsienlu, 2, (M.C.Z., without skulls); no exact locality, 1.

No exact locality, 2.

212. **Felis pardus fontanierii** Milne-Edwards

NORTH CHINA LEOPARD

Felis fontanierii Milne-Edwards, Ann. des Sci. Nat., Zool., ser. 5, vol. 8, p. 375, 1867.

Leopardus japonensis Gray, Proc. Zool. Soc. London, 1862, p. 262, pl. 33 (not *Felis catus η japonensis* Boddaert, 1785).

Leopardus chinensis Gray, *ibid.*, 1867, p. 264, fig. (not *Felis chinensis* Gray, 1837).

Felis pardus Buechner, Bull. Acad. Imp. Sci. St. Pétersbourg, vol. 34 (new ser., vol. 2), p. 100 (Mélanges Biol., vol. 13, p. 146), 1892.

Felis pardus var. *chinensis* Trouessart, Cat. Mamm. Viv. Foss., p. 354, 1897.

Felis pardus var. *fontanieri* Trouessart, *loc. cit.*

Felis pardus grayi Trouessart, *ibid.*, p. 268, 1904 (new name for *chinensis*, not of Gray).

Panthera hanensis Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 198, 1908.

Panthera pardus japonensis Pocock, Journ. Bombay Nat. Hist. Soc., vol. 34, p. 320, 1930.

Panthera pardus bedfordi Pocock, *ibid.*, p. 323, pl. 10.

Type specimen:—The type specimen of Milne-Edwards's *Felis fontanierii* was a skin and accompanying skull obtained in the neighborhood of Peiping by the French consul, M. Fontanier, and sent by him to the Muséum d'Histoire Naturelle at Paris. Gray's type of *Leopardus japonensis* was a trade skin said to have been exported from Japan. It is figured by the author and presumably is still in the British Museum. Since, however, the leopard does not occur in a wild state in Japan, the skin in question must have come from the mainland of North China. Gray's *Leopardus chinensis* was based on a skull from the mountains west of Peiping, China, in the British Museum.

Description:—It is generally agreed that the leopard of North China is different from that of the southern parts of the country, but the definition of such differences is not easy. Apparently, however, the northern animal has a longer winter pelage and averages somewhat paler, with less intense ochraceous background in the color of the pelt, a tawny buff instead of the richer tone of southern skins. Available figures do not indicate any significant difference in size. In the winter pelage, however, the hair of the back is at least 40 mm. in length, whereas the South China leopard has a much shorter fur, that of an adult from near Ichang in February having the long hair of the back half that length. Jacobi describes the tint of the ground color in skins from near Peiping as nearly "orange buff."

Measurements:—Few measurements of North China leopards, taken in

the flesh, are available. Milne-Edwards notes the length of the type skin as: head and body, 1,170 mm.; tail, 750. Sowerby says that in North China an animal that measures seven feet (about 2,135 mm.) is not considered out of the ordinary, doubtless implying an adult male. Pocock (1930, p. 323) gives the flesh measurements of an old female from southeastern Shensi, as: head and body, 43¼ in. (1,095 mm.); tail, 31 in. (790 mm.).

The skull according to Pocock (1930) averages slightly larger than in Indian specimens, and Anderson (1879) believed, from a comparison with Indian skulls, that "the muzzle is not so deep, but is more elongated." Busk (1874) has published a few comparative details of Chinese leopard skulls also.

CRANIAL MEASUREMENTS OF NORTH CHINA LEOPARDS

Source	Greatest length	Basal length	Palatal length	Zygomatic width	Width across molars	Upper cheek teeth	Lower cheek teeth	Sex	Locality
60106	193	160	85	123	75	65	73	?	Shensi
chinensis (type)	180	—	—	117	—	—	—	♀	Hopei
bedfordi (type)	196	—	—	130	—	—	—	♀	Shensi

Nomenclature:—Most unfortunately the nomenclature of the North China leopard is much involved. Pocock (1930), in his review, has revived Schlegel's *Felis orientalis*, 1857, for the Korean Leopard and believes it extends into North China, meaning probably Manchuria, and north into Amurland. He distinguishes the North China leopard from Hopei as *Panthera pardus japonensis*, assuming that the type of Gray's trade skin, bought in Japan, really came from North China, especially since this specimen agrees in color very closely with Milne-Edwards's colored plate of *Felis fontanierii* from Peiping. If one accepts *Panthera* as a full genus, Pocock's combination will, therefore, stand as the proper name for this race. If, however, one uses *Felis* as the generic term, the subspecific name will have to be abandoned for *F. fontanierii*, since *japonensis* had previously been used for a race of *Felis catus* by Boddaert, in 1785; and for the same reason the next proposed name, *Leopardus chinensis* of Gray, 1867, is not available, for Gray himself had previously given the name *Felis chinensis* to the small, spotted Tiger Cat. Trouessart, who used *Felis* as the generic term for the leopards, perceived this some thirty years later, and in his "Catalogus" proposed *Felis pardus grayi* as a substitute, based on Gray's North China animal. This was unnecessary, however, for the earlier *F. p. fontanierii* is an exact equivalent, and is the proper term in combination with the generic name *Felis*, whereas *japonensis* is correct in combination with *Panthera*. A still further complication enters the case, in that Pocock, on the basis of two skins from southeastern Shensi, one from Hupeh, and a fourth purchased in Peiping (the type locality of *F. p. fontanierii*), erects for these a new race, *P. p. bedfordi*, on the ground that they are "paler and much less richly coloured." The first three, however, are in winter coat or nearly so, the

type (labeled November 8) having the fur of the back about 25 mm. long. The skin from Hupeh referred to this race is that of a young animal, with the pattern, as usual in immatures, less clearly defined, taken in January. Considering the wide variation shown in the pattern and general tone of leopard skins, it does not seem that this race can be well founded, but is really based on winter skins (disregarding those from Peiping, one of which is immature). I have examined a fine male specimen from Ichang, Hupeh, killed in early February, which, on account of its short hair (20 mm.) and rich coloring, I assigned to the South China subspecies, so that it seems more likely that the male Pocock mentions from the same province owed its light coloring to immaturity. Certainly it seems more reasonable to regard the Shensi leopard as at most an intergrade between the North China and South China forms, but, on account of its longer and paler winter pelage, to be best associated with the former. Should the more exact study of a sufficient series of leopards ever show that the Shensi animal is a recognizable form, it will have to be called *P. hanensis*, a name given in 1908 by Matschie to the leopard of the same region in southeastern Shensi, though based on purchased skins, from Hinganfu.

Occurrence and Habits:—Sowerby (1923g) writes that the leopard is at present found in only the southwestern part of Manchuria, and appears to be the same there as in North China. In the mountains to the west of Peiping it apparently is still to be found, as in Fontanier's day, for Jacobi (1922) mentions one secured by the Weigold Expedition, with thickly haired tail, markings and ground color as described for this race. Elsewhere, it seems to occur in small numbers, generally over most parts of North China, where there is sufficient wild country with cover to hide in by day, as in Chekiang, Kiangsi, and Anhwei Provinces (Sowerby, 1925c), and westward along the Tsingling Range into southeastern Shensi, whence Pocock records (as *Panthera pardus bedfordi*) an old female from the Shangchow district, another from Paoli, and Matschie (as *Panthera hanensis*) skins obtained in Hinganfu. It apparently avoids the desert country and loess and thus is absent from much of Shansi and northern Shensi, but is recorded from Taiyuanfu (Shansi) by A. B. Howell (1929). According to Buechner (1892), it is everywhere common in southern Kansu. Berezovski secured two near Choissjan in that country, and Jacobi (1922) records a melanistic skin from Sungpan, with fur even thicker than that of a December specimen from Peiping.

As to its habits, Sowerby (1923g) briefly summarizes his own experience in saying that it usually has a number of lairs in which it hides by day and is a great traveler, ranging over a wide district, a single animal believed to cover as much as twenty to thirty miles in a night. Often it follows the tops of ridges where wild pigs have trodden out regular paths. The young are usually

two in number as with the southern animal. It feeds on small deer and game birds, and frequently descends upon some mountain village to carry off domestic animals, dogs as elsewhere being especially sought. The natives hunt the leopard with guns, and often use poisoned bait, but have no way of trapping it. As with other wide-ranging mammals, its very mobility would act to prevent the local breaking up into well-marked races, except where a majority of individuals are subjected to similar extremes of climatic conditions.

Specimens examined:—One only, viz.:

Shensi: 1 skull.

213. **Felis tigris amoyensis** Hilzheimer

THE SOUTH CHINA TIGER

Felis tigris var. *amoyensis* Hilzheimer, Zool. Anzeiger, vol. 28, p. 598, 1905.
Tigris tigris Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 18, 1922.
Felis tigris G. M. Allen, Amer. Mus. Novitates, no. 360, p. 13, 1929.
Panthera tigris styani Pocock, Journ. Bombay Nat. Hist. Soc., vol. 33, p. 531, pl. G, 1929.

Type specimens:—Five skulls sent from Hankow, Hupeh, China, formed the basis of Hilzheimer's name, and were believed to have come from that immediate region. These specimens are in the Strassburg Museum, but their numbers are not mentioned. All are cotypes.

Description:—The general type of coloring in all the races of tigers that have been described is much the same, with great individual variation in the degree of the complexity of the markings. The general ground color of the dorsal surfaces is an ochraceous tawny, usually clear on the feet and the nose. The head markings are somewhat as follows: the lower eyelid is narrowly bordered by white, and the upper eyelid is similarly marked, except that it joins a whitish area on each temple extending back about half-way to the ear. This whitish area is crossed by the anteriormost of some four or five narrow transverse black stripes marking the forehead, this particular stripe rather T-shaped, with a zigzag stem and its crossbar an elongate spot over the eye. A small black mark is present at the anterior corner of the eye, while from the posterior corner extends backward a short black stripe ending on the cheek in a short vertical bar. Of the transverse head stripes, the anteriormost is the broadest, those behind much narrower, and the second or third nearly continuous with a narrow black band that passes continuously around the upper throat. There is a black line from just behind the angle of the mouth, curving under the eye, then dividing into a short upward and another downward branch. Other small irregular spots or lines are present between the eyes, or on the sides of the face and muzzle. The cheeks are like the ground color of the back, but the sides of the muzzle, the chin, throat, belly and inner sides of the limbs are white with scattered blackish transverse bars. The backs of the ears are black with a whitish transverse

mark half-way up. The details of the stripes across the neck, body, shoulders, and haunches vary individually, so that hardly any two are exactly alike. Thus among three skins obtained by the American Museum Asiatic Expeditions in Fukien, one, an adult male, has the body stripes much broken into broad lozenge-shaped blotches, with wide borders enclosing a bright rufous center, while the stripes on the hips are clear, wide, and continuous. A second skin shows the opposite extreme, with very narrow stripes, much less broken over the body, but tending to be short or incomplete; the third specimen is somewhat intermediate, with the stripes more broken and tending to form blotches enclosing a tawny center but open on the upper anterior part. The transverse markings are continued on to the tail in the shape of a dozen or so rings, usually with tawny centers, and ending in a short black tip. Rarely individuals show melanism, as in the case of the famous "blue tiger" of Fukien, whose coat appeared a very dark almost bluish color (Caldwell, 1924).

The skulls of tigers may usually be distinguished from those of leopards by their size, the greater elevation of the forehead, and by the concave lower profile of the jaw. The nasal bones, too, are usually longer in proportion, exceeding the backward extent of the maxillaries. The flatter forehead, greater size, and broader nasals of lion skulls will usually distinguish that species also, but Pocock (1929) has shown that this is not always the case when a large series is examined. The South China Tiger, according to Hilzheimer (1905), differs in a number of skull characters from that of India: (1) in side view the highest point of the skull is in front of the postorbital processes, from which point the outline declines fore and aft in nearly a half circle, whereas in Indian specimens the highest point is over the processes; (2) the occipital triangle is more truncate as seen from the rear; (3) the skulls average slightly smaller than in the Indian animal; (4) the upper carnassial has a small antero-external accessory cusp in the Indian animal which is lacking in the Chinese; (5) the last lower premolar in the Chinese tiger is said to have a narrower cingulum and a more tapering anterior portion as seen from above. All these small points, however, seem subject to individual variation and do not hold good in the series that I have been able to study.

Measurements:—Swinhoe (1870c) tells of a male tiger killed at Amoy, that measured from snout to base of tail, 64 inches; tail, 30 inches; ear, 5.5 inches; girth of chest, 40 inches. It weighed 330 pounds. Pocock (1929, p. 530), who examined a number of furrier's skins shipped from Shanghai, found that the largest measured only 9 feet 9 inches, in total length, and that was no doubt considerably stretched in skinning and pegging out. He regards the South China Tiger as distinctly smaller than the Indian. Nevertheless, it is a large Indian Tiger that will measure 10 feet in total length.

CRANIAL MEASUREMENTS OF *FELIS TIGRIS AMOYENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Median length of nasals	Upper cheek teeth	Lower cheek teeth	Length of upper carnassial	Sex	Locality
45519	318	259	145	210	125	105	95	97.0	116.0	35	♂	Fukien
45520	273	225	127	190	110	98	76	91.0	99.0	32	♀	Fukien
47863	—	—	128	—	—	—	88	90.5	98.5	31	♀	Fukien

Nomenclature:—It is difficult to find characters that will satisfactorily separate the tiger of South China from that of India, for on account of the individual variation obvious in relatively trivial details, it is hardly possible to pick out any one that will hold good in a series. Nevertheless, the impression prevails among those well acquainted with both, that the South China Tiger is distinct. Dr. Ernst Schwarz writes me that he has repeatedly seen living animals brought to Berlin from South China and Indo-China, and finds them slightly different from Indian Tigers, while Mr. James H. Fleming, who has handled many skins, states positively that the Tiger of the Indian Plains is a very washed-out, short-haired, and narrow-striped beast as compared with the South China animal with its fuller coat, deeper color, and wider stripes. Pocock, in his review of the tigers, has independently arrived at the same conclusion. He writes that, having inspected a large number of the so-called Hankow skins at a furrier's, he found they averaged smaller than Indian tigers, darker, and more fully striped, with a somewhat longer and softer, though variable, coat. "The tint was also variable as well as the pattern which consisted sometimes of stripes mostly looped, or diamond-shaped with darker centers, sometimes unlooped and sometimes complete from the nape on to the fore leg, sometimes interrupted. The extent of the white on the belly as compared with the coloured area was variable." To this tiger he gave the name *Panthera tigris styani*, selecting as type a skull collected by Styan in "North China," but probably from somewhere in the latitude of the Yangtze valley, for most of Styan's collecting seems to have been done south of latitude 30°. This name is thus practically an exact equivalent of Hilzheimer's *Felis tigris* var. *amoyensis*, based on skulls from the Hankow region, and so named because the fur dealers are said to call the skins shipped from Hankow and Shanghai, Amoy Tigers. This name will, therefore, have to be used instead of *P. t. styani*.

Occurrence and Habits:—Tigers are relatively common, for a large beast of prey, in many parts of southern China. E. H. Wilson (1913, vol. 2, p. 178)

writes that in Hupeh, in the western part, a few are found and their skins are frequently brought in. The rocky precipitous gorges in the regions of Changyang and Patung are favorite haunts. To the westward, tigers are very rare in western Szechwan, though occasionally found "in the jungle-clad wilderness around Wa shan"; they are more common, however, in the Chiencharg valley and southward through Yunnan, where doubtless they grade into the Indian race. Weigold (1923) corroborates Wilson's statement, and says that very little trace of tigers is to be found in Szechwan. In the mountains at Yenpayi, west of Wanhsien, however, as well as in Djinshan, they are said still to be found. In Wassuland on the upper Min, he was told that a wandering specimen had been killed over a bait in mid-winter a few years before. In southeastern and southern China, tigers seem still to be fairly plentiful. Swinhoe (1870c) wrote that in 1858 several appeared on the bare hills near Amoy, killing livestock, and in some instances natives. One swam across to Amoy city, on an island, and was chased into a house, where it was killed by matchlocks through a hole in the roof. It was in this section that Dr. W. L. Smith hunted them in the late nineties, killing one that weighed 385 pounds, while so recently as 1925 an old male was killed on Amoy Island, that was supposed to have come from the mainland five miles distant (Chi Ping, 1927). In southern Kwangtung, Mell (1922) writes that tigers are now only occasional visitors, as the country is largely cleared and thickly settled, but in the northern part of the province they are commoner in the rough mountain regions, as at Tanhashan. In the watershed between the North and East Rivers, the Chinese kill them by using large bamboo crossbows in traps, shooting ten bamboo arrows tipped with poison. It is said that the tiger, licking the wounded place, gets the poison on its tongue, which swells until it suffocates the animal. Tigers are still met with in fair numbers in Fukien, but to the northward are few. Sowerby (1925c) writes that in Anhwei a tiger that was said to have carried away three children, was killed the first of February, 1925, and publicly displayed on the streets of Anking, while another report told of tigers killing natives in the Tinte district of Chekiang. Writing in 1930, however, Sowerby (1930b) reports a nine-foot tiger shot in the Kekwan Mountain region shortly before and brought in to Shanghai. Tigers are now almost unknown in Chekiang, so that this capture lent probability to a report of one at Mokanshan at that time. North of the Yangtze valley, tigers must be exceedingly rare, though Sowerby (1918) has reported seeing tracks in western Shansi, and in a later note (1933a) reports the definite capture of one in southern Shansi, at Pehfang, twelve miles north of Chiehchow and in January, 1933, the shooting of two others, both youngish animals, close to Lingying monastery, near Hangchow, while a correspondent quoted in the same note tells of a "black" tiger killed in the Eastern Tombs forest about 1912.

A good deal has been written about hunting tigers, but few sportsmen have made the painstaking study of the animals in their chosen haunts that H. R. Caldwell (1924) has embodied in his book, "Blue Tiger." Indeed, to follow the animals into their lairs and still-hunt them as he did, one must have not only infinite patience and daring, but absolute faith in the accuracy of one's rifle and ability to use it. A brief résumé of some of the interesting points brought out in hunting tigers near Yenping, Fukien, follows. Tigers are by instinct cowardly, yet at times boldly attack human beings, even entering the native dwellings to seize and carry off a child. They are adepts at stalking and make use of slight cover with surprising skill. Caldwell mentions an instance where a tigress lay for three hours on a grassy terrace in plain view watching a bleating goat staked out as a lure. When she finally decided to make the attack, she moved rapidly forward toward her intended quarry to within striking distance, when an accurate shot brought her down. On another occasion, while watching a tiger from a blind, this observer saw the animal advance to within thirty yards of a goat, peering occasionally into a valley where two men were at work more than five hundred yards distant. After a time, as if suspecting a trap, it turned and vanished silently into the bush. A few days later, however, the same animal charged boldly upon a cow and killed it, although its owner sat not ten yards away eating a midday lunch. Tigers will even attack a goat or cow being led by a rope, killing it instantly. "Often after securing his victim, courage seems to fail and he abandons the kill, bounding off into the nearest bush." In one case three men in gathering fuel on a grassy terrace, roused a tiger which charged at once, crushing the skull and neck of two and striking the third a blow that "landed him lifeless on the terrace below." This animal made no attempt to drag any of the three victims to cover. Again, near Yenping, a lad walking along a trail with his father, was seized by a tiger, which fixing its teeth in the boy's skull, made off with him, followed by the frantic father, calling for help. After making good its escape, the tiger released the boy, paying no attention to the father, but seeing a man working in the field a short distance away, attacked and killed him, making off without attempting to devour the body. Many such instances are related. As illustrative of the animal's tremendous strength, Caldwell recounts a case where a tiger leaped from above into a pen where a heifer was kept, killed it and leaped out carrying the heifer bodily up an embankment which was measured and found to be twelve feet high. The same tiger attacked and dragged away for more than half a mile the carcass of a hog dressing two hundred pounds. This animal was shot and proved to be a male weighing a little more than four hundred pounds.

The food of the tiger consists of various game animals, especially wild pig, small deer, as muntjacs, even porcupines and pangolins. Favorite lairs

frequently show the remains of these animals about, and are sometimes raided by the Chinese for the pangolin scales, to which medicinal value is attributed. Caldwell includes even frogs among the articles of diet, and mentions a case where a man carrying a sack of frogs one night was attacked and killed by a tiger that had apparently been attracted by the croaking of the frogs, for no attempt was made to drag away the man, although the sack of frogs was ripped and torn. Frequently trees are found along the trails frequented by tigers, showing where the tigers have reached up to claw the bark, just as the smaller cats will do. Such signs, sometimes at a height of eight feet from the ground, are looked for by the hunter to give some idea of the presence and size of the animals.

The number of young is not large. Caldwell reports once finding a tigress with four kittens, and on another occasion he came upon a company of five together, which may have been an adult with her young, for one of them that was killed proved to be a young male. Mell (1922) believes that in South China the young are born in winter, and instances a litter of two found in December in the Tsingyuan region (Kwangtung), while in another case, he saw a litter consisting of two young about a fortnight old in the limestone mountains near Pingloh. W. Forsyth (Journ. Bombay Nat. Hist. Soc., vol. 20, p. 1148, 1911), writing of the Indian tiger, notes that a female killed, contained five fetuses, and other writers in the same journal have recorded in one case four, in another six for the same race, although two is the usual number of young seen with the parent (*ibid.*, vol. 21, pp. 1062, 1063, 1912).

Of domestic animals, dogs are a favorite food, as with leopards, while the toll taken of human lives is often excessive. In one neighborhood, Caldwell reported no less than sixty people having been killed by tigers within a few weeks. He had never seen anything to bear out the belief that large animals are attacked from behind. Several attacks upon cows that he personally watched, proved that the tiger "attacks from the side and below, fastening its fangs in the neck in the region of the jugular vein, and, by placing the fore paws upon the chest, breaks the neck by a sudden wrenching of the head. Examination of a number of killed cows has proven in each case that the neck was broken." He instances an interesting case where he watched a medium-sized tiger stalking a tame water buffalo and her calf. The cow stood in about six inches of water and kept her body between the calf and the tiger as the latter manoeuvered along a dyke for a spring. It finally sprang from a terrace above, landing squarely upon the cow's back, as Caldwell believed, more as a ruse to reach the calf than in a planned attack upon the cow. The latter, however, by a quick flinching movement as the tiger struck, skidded it off, landing it upon its back in the mud and water, whereupon it picked itself up and strode away "with all the dignity of its kind."

In southern China tigers are hunted in the barren Amoy region by being followed into the caves and fissures that abound among the rocky hills, the hunters arming themselves with long three-pronged pikes. These are held in front as the hunters advance into the passages, so that in case of a charge the animal will impale itself. A white hunter stationed outside may often obtain a momentary chance for a shot at such occasions, when the tiger slips out from one of the entrances rather than face the spearmen. An account of this form of hunting has been given by Dr. W. L. Smith (1928). Another method used by the Chinese is for the hunter to prepare a cage of stout bamboo poles into which he retires with a kid as a lure. The tiger, in attacking, springs upon this cage, from the shelter of which the hunter shoots arrows into its belly at arm's length, surely an exciting experience. At the present time, with modern weapons and the spread of larger communities, tigers must inevitably decrease, but for long periods they have been a source of danger to the Chinese, who for centuries have regarded them as the embodiment of strength and vigor, to the extent that their blood, bones and flesh are in great demand as "medicine" for imparting various virtues to the consumer.

Lanning (1911) gives an interesting account of the tiger in China, from which the following notes are abstracted. In January, 1875, a tiger was killed within five miles of the city gate of Ningpo, Chekiang, that had caused the death of two men. Its length was said to have been 8 feet, 2 inches. Archdeacon Moule, in Wade's "With Boat and Gun in the Yangtze Valley," says that three times within his memory tigers had visited the neighborhood of Ningpo, though its chief "home is amongst the mountains of Taichow." In 1880, a tiger was killed near Hangchow. It was first brought to bay with an arrow shaft. Lanning had a note of a tiger that leaped into a yard at Newchwang, seizing a pig, which it dropped when fired upon. In the Canton delta, where tigers seem to be common in suitable cover, no less than twenty people fell victims to man-eaters in a certain year. In 1894 a tiger was killed close to the west gate of Foochow that had killed a man a few days before. In 1897 a tigress was shot at Kuliang, a few hours' distant, that measured 7 feet 11 inches in length and weighed 205 pounds. In 1895 tigers were reported on the Talung Shan, near Nanking. Lanning's account of the manner in which tigers kill their prey, independently corroborates that of Caldwell, for he says "the attack is made by a sudden rush of only a few yards. If the prey be an ox or a deer it is seized by the throat from below. Whilst the teeth are thus engaged, the fore paws take hold one on each side of the fore quarters. Then a quick wrench, sometimes aided by a spring to one side, breaks the neck, and the operation of killing is over."

Specimens examined:—Three, from Fukien, China (Futsing, 2; Yenping, 1); one from India.

214. **Felis tigris amurensis** Dode

THE MANCHURIAN TIGER

Felis tigris var. *amurensis* Dode, Proc. Zool. Soc. London, 1871, p. 480.
Felis tigris longipilis Sowerby, Naturalist in Manchuria, vol. 2, p. 29, 1923 (in part).
Panthera tigris amurensis Pocock, Journ. Bombay Nat. Hist. Soc., vol. 33, p. 527, 1929.

Type specimen:—No type is mentioned in the brief and informal description of *F. t. amurensis* by Dode, although it is implied that a specimen was exhibited at the meeting of the Zoölogical Society of London when he proposed the name, and Pocock (1929, p. 527) speaks of a type skin as if there were one in existence, at the same time fixing the type locality as the west bank of the Ussuri River in Manchuria.

Description:—According to Pocock's summary of the notes of Dode, Swinhoe, and Temminck, this northeasternmost of the races of the tiger is distinguished by being paler colored, less richly striped, and thicker coated. Probably the last is the most striking character, for, mounted side by side with an Indian Tiger, the Manchurian animal is essentially similar in important characters, though markedly thicker coated, with well filled-out tail. No doubt, however, almost every tiger skin that comes from Manchuria and Amurland is a winter specimen, in thick coat, so that the impression of a larger size has become general, with very little real basis for it, as Pocock (1929) has shown. Indeed, he says that the only available skull he had is smaller than that of average North Indian tigers.

Measurements:—Pocock gives the measurements of a tigress sent from Vladivostok to the London Zoölogical Gardens as: head and body, 74 inches; tail, 34 inches, or a total length of nine feet, "no larger, that is to say, than a North Indian tigress." Nevertheless, large individuals no doubt do occur.

The skull, likewise, seems to show no tangible differences, unless it may be found to average a little smaller. Busk (1874) gave the following for a male skull from Manchuria (converted into millimeters): greatest length, 345 mm.; condylobasal length, about 305; zygomatic width, 225; nasals, 117 by 56; upper carnassial, length, 36.

Nomenclature:—Although sometimes called the Mongolian Tiger, and the name *mongolica* used in a subspecific sense for the Manchurian race, Pocock (1929) has pointed out that the latter is a *nomen nudum*, and that the term *T. longipilis* of Fitzinger applies to the tiger west of the Gobi, if again that is a recognizable form. Dode's name *amurensis* is thus the first to be given to the tiger of the extreme northeast. It remains to be shown how different this really is from the more western tigers.

Occurrence and Habits:—Probably this race of the tiger used formerly to range across the wooded parts of northern China, and intergraded with

the subspecies *F. t. amoyensis* to the northward of the Yangtze basin. Its exact limits can only be guessed at, however, for at the present time it is nearly extinct in this area, though still fairly plentiful in Manchuria. Sowerby says (1923g, vol. 2, p. 31) that in Hopei "it still occurs in the wilder parts of the Tung Ling and Wei Ch'ang (the Eastern Tombs, and Imperial Hunting Grounds) to the North-east and North of Peking, and throughout the forested areas of Manchuria, the Amur, and Ussuri, into Primorsk in the extreme east." He mentions further that he has seen skins of tigers that were said to have come from the Kweihwacheng district of northern Shansi, "undoubtedly of the true long-haired type," but this must be rather unsuitable country for them, with its abundance of open areas. It is extremely doubtful if the tiger is found in any of the more desert open country of the Gobi, and indeed Pocock says he has never seen an authentic specimen from Mongolia. Hunters agree that in the forests of Manchuria, the tiger's main subsistence is wild pig, the trails of which it persistently follows.

Specimens examined:—None from China; from Manchuria, one (M.C.Z.).

Genus **Lynx** Kerr

Lynx Kerr, Animal Kingdom of Linnæus, vol. 1, Mamm., p. 41, 1792.

The lynxes are, as Pocock (1917) has shown, closely related to the other smaller cats, having a bony suspensorium for the larynx, and in his classification are given generic rank in the subfamily Felinæ, coordinate with that of the other "groups." In the case where, as here, these groups are regarded as subgenera, it might be more consistent, therefore, to accord similar rank to the lynxes. Nevertheless the latter form a better-marked assemblage than most of the subgenera of smaller cats, in the combination of much shortened tail, the loss of the upper first premolar, shortened rostrum, and narrow, backwardly tapering ascending branch of the maxillary, which does not encroach upon the nasal to such an extent as to cause a sudden narrowing of its posterior half. Externally they are characterized by the heavy hind quarters, that are higher than the fore, and probably in quick turns compensate by their size and weight for the greater balancing power of a longer tail; the ears are penciled, and the males usually have a well-marked ruff at the sides of the throat. It is true that in some of these points, as in the rather longer tails of caracals, or the usual absence of the small upper premolar in such cats as *F. bengalensis*, intermediate conditions are shown, but on the whole the lynxes seem to be as well marked a group as most of the subdivisions of the more typical cats.

A single race of lynx seems to reach the borders of western China and northern Mongolia.

215. **Lynx lynx isabellina** (Blyth)

Felis isabellina Blyth, Journ. Asiatic Soc. Bengal, vol. 16, p. 1178, 1847.
Felis lynx isabellina Wilson, Naturalist in Western China, vol. 2, p. 181, 1913.
Lynx isabellina Jacobi, Abh. u. Ber. Mus. f. Tier- u. Völkerk., Dresden, vol. 16, no. 1, p. 10, 1922.

Type specimen:—"An imperfect skin" from "Tibet," presumably still in the collection of the Indian Museum at Calcutta.

Description:—This is a large lynx; a specimen from near Urga, Mongolia, is a general frosted reddish above, white below with a few blackish spots on the inner side of the fore limbs and on the sides of the belly; outer sides of the legs and the flanks with indistinct reddish spots; a broad white border to the eyelid, interrupted by a small black spot near the posterior upper margin; cheeks with three or four indistinct stripes of reddish brown; upper half of the ear, its terminal pencil, a spot on the lower cheek, and the tip of the tail, black.

Measurements:—No measurements of the exterior nor any skull dimensions are available.

Occurrence and Habits:—The exact status of the lynx in China is difficult to determine. It apparently is present in small numbers from about the region of the Eastern Tombs, northward following the southern borders of the evergreen forest into northern Mongolia. Rhoads (1898, p. 124) records a fine adult captured in the Imperial Hunting Park, Hopei. The American Museum Asiatic Expeditions brought back a beautiful skin without skull, secured fifteen miles northeast of Urga, Mongolia, which is a point about on the southern limit of the boreal evergreen belt, here bordering the Gobi. Sowerby (1923g) also speaks of having seen skins, which he refers to this race, from the forest area of northern Mongolia. To the westward of the Chinese borders, a good many lynxes are taken and brought in for sale to various Chinese fur marts. Pousargues (1896a) mentions one brought back by Prince Henri d'Orléans in the course of his journey from Batang to Yunnan. E. H. Wilson (1913) writes that they are brought into Sungpan, western Szechwan, from the neighboring parts of Tibet to the west and north and find ready sale among the wealthy Chinese. He describes the pelt as dark gray, very thick and soft. In Sungpan they sell for from five to seven taels each. Weigold (1923) also mentions that they are held for a high price at Sungpan, and are all brought in from the interior of Tibet. It is quite possible that these are of a different race from the reddish-gray lynxes of northern Mongolia and Hopei.

Specimens examined:—One from Mongolia, fifteen miles northeast of Urga.

CHAPTER VIII

ORDER PINNIPEDIA

SEALS, SEA-LIONS

THE seals and their relatives, the sea-lions, fur-seals, and walruses, represent an offshoot of the Carnivora whose members have become specialized for an aquatic life and the pursuit of fish or other sea-life, though the process of adaptation has not been carried to the extent that it has among the Cetacea, for the hairy covering is still retained, the fore and hind limbs are both well developed, and the teeth still show the transverse row of incisors, followed by a specialized canine and a series of premolar and molar teeth, which, however, tend to become of similar shape, with compressed cuspate crowns, adapted for catching fish. Seals spend much of their time in the water, but also delight to haul out on rocky or sandy shores to bask in the sun.

The order may be divided into two main groups, the eared seals, comprising the family Otariidæ, and the hair-seals, constituting the Phocidæ. A third family, somewhat intermediate in certain ways, is that including the walruses, Odobenidæ. The Otariidæ as a family is in many ways more primitive than the Phocidæ, for its members still retain a pelt consisting of under fur and over fur; they have very small external ears, and the hind feet, though flipper-like, can still be turned forward when the animal ambles about on land. In the Phocidæ, however, the soft under fur of the coat is lost, only the stiffer long hairs remaining, there is no external ear, and the hind feet are no longer capable of being turned forward, so that on land the animal no longer walks on all fours but is obliged to hunch its body along caterpillar-like. This may have a relation to the method of swimming in the two groups, for the former row themselves about with the enlarged anterior limbs, while the latter use the hind feet chiefly for propulsion. The Otariidæ still retain a considerable supra-orbital process in the skull, but this is quite lost in the Phocidæ; also, their teeth are simpler and more peg-like.

It is odd that almost nothing is definitely known about the seals of the Chinese coasts. Not only are there apparently no specimens available in western museums, but it is still a matter for investigation to learn what species

are present and when. Except for a few brief references by Swinhoe (1870c) and Sowerby, there is apparently nothing in print on the subject. In 1902, the late Dr. J. A. Allen brought together the material available representing the hair-seals of the North Pacific, and published a preliminary review of the species, describing a few new forms. It was obvious that most of the species frequent more northern waters than those of the Chinese coasts, for which he gave no records. Sowerby (1925d), commenting on an erroneous report of seals at Shanghai, says that both sea-lions and seals occur on the Chinese coasts, but the only definite statement I can find is in his book, "The Naturalist in Manchuria" (1923g, vol. 2, p. 80), on the authority of which the Kurile Fur-seal is included. The hair-seal is likely to prove some form of the Pacific Harbor Seal, *Phoca richardii*. It is much to be desired that specimens, or at least skulls, of Chinese seals should be preserved at any opportunity.

Family OTARIIDÆ

FUR-SEALS AND SEA-LIONS

The seals of this family have evolved along a different line from that of the hair-seals. They still retain the ability to turn the hind foot forward, and the swimming power is largely placed in the long fore limbs which row the body along, whereas in the hair-seals the fore limbs are short and propulsion is accomplished mainly by hind limbs which are permanently turned backward. The coat is a true fur, with a short dense under pelage and a longer over fur of stronger hair which possesses a striking sheen.

Genus **Callorhinus** Gray

Callorhinus Gray, Proc. Zool. Soc. London, 1859, p. 359 (not invalidated by *Callirhinus* Blanchard, 1850, in Coleoptera).

Callotaria Palmer, Proc. Biol. Soc. Washington, vol. 7, p. 156, July 27, 1892.

This genus includes the fur-seals of the North Pacific. It differs from the fur-seals of the genus *Arctocephalus* of the southern oceans in having the facial portion of the skull more convex, less lengthened and narrowed, and in having shorter nasals. The ascending branch of the premaxillary is narrowed to a small waist at the sides of the nasal opening, then broadens out dorsally to form a wide contact with the nasal, a point distinguishing the skull readily from that of the sea-lions. The cheek teeth are simple with conical points. The molars are reduced to two above and one below, giving the following tooth formula: $i.\frac{3}{2}$ $c.\frac{1}{1}$ $pm.\frac{4}{4}$ $m.\frac{2}{1} = 36$. The type species is *Callorhinus ursinus* (Linnæus) of Bering Island.

216. **Callorhinus curilensis** Jordan and Clark

KURILE FUR-SEAL

Callorhinus curilensis Jordan and Clark, Fur-seals and Fur-seal Islands of North Pacific, pt. 3, p. 3, 1899.

Type specimen:—No type specimen is mentioned by the authors of this

species, who merely say in a casual way that the name is proposed for the fur-seal of the western Pacific; Robben Island is the type locality.

Description:—The Kurile Island Fur-seal is apparently much the same in its dark blackish color as the Alaskan species, but differs in that the under fur is whitish instead of the rusty tint of the more eastern animal.

Measurements:—No skulls are available, nor have any comparative measurements of this seal been published, apparently.

Occurrence and Habits:—The fur-seals that concentrate for their breeding season on the Kurile Islands, and on Robben Island, considerably farther to the west, are supposed to remain distinct from the herd that breeds on the Pribilof Islands, and to migrate southwestward in early autumn to the seas east of the Japan coasts. Here, at least, the bulk of the catch was taken when in former times pelagic sealing was allowed. No doubt occasional individuals stray considerably farther to the south, for Sowerby states that they are said to occur "off Chefoo (North Shantung) and Shanghai." It must be admitted that this is rather slender evidence upon which to base a positive record.

Specimens examined:—None.

Family PHOCIDÆ

HAIR-SEALS

The obvious characters separating the two families of seals mentioned have already been enumerated. Of the several genera of hair-seals, probably at least one occurs as far south as northern China.

Genus **Phoca** Linnæus

Phoca Linnæus, Syst. Nat., ed. 10, vol. 1, p. 37, 1758.

Externally, the fingers of the hand in this genus are either subequal, or they decrease very slightly in length from first to fifth. The skull is somewhat flattened, with broad brain case, large orbits which look forward and upward, and a narrow interorbital space. The lower incisors are reduced to two on each side, and the molars to one in both jaws, giving a tooth formula of $i.\frac{3}{2}$ $c.\frac{1}{1}$ $pm.\frac{4}{4}$ $m.\frac{1}{1} = 34$. The first premolar above and below is single-rooted; the other premolars and molars are two-rooted, with the crowns more or less tricuspid. The type species of the genus is the common Harbor Seal (*Phoca vitulina* Linnæus).

The genus *Phoca* is the most widely distributed of the family, and, though abundantly represented in the boreal seas, extends in the North Atlantic at least as far south as the latitude of Virginia, so that its occurrence on the eastern coast of China at a corresponding latitude seems very probable.

217. Phoca ?richardii (Gray)

PACIFIC HARBOR SEAL

?Halicyon richardii Gray, Proc. Zool. Soc. London, 1864, p. 28, fig.
?Otaria stelleri Swinhoe, Proc. Zool. Soc. London, 1870, p. 633.

Type specimen:—The type was a skull from Vancouver Island, British Columbia, in the British Museum.

Description:—The Pacific Harbor Seal is similar to the Atlantic Harbor Seal in the general mottled dark and light coloration. The chief obvious difference is in the skull, in which the premaxillæ are more prolonged posteriorly, so that their tips are in more extensive contact with the nasals. The teeth, as characteristic of the genus, are: i.$\frac{3}{2}$ c.$\frac{1}{1}$ pm.$\frac{4}{4}$ m.$\frac{1}{1}$ = 34, with the premolars and molars compressed and provided with from three to four sharp cusps arranged along the axis of each tooth.

Occurrence and Habits:—It is not definitely known that this is the hair-seal of the Chinese coasts, but since the species occurs in the eastern Pacific along the Californian coasts, it is probable that it would extend southward on the western side about as far. Swinhoe (1870c, p. 633), under the heading "*?Otaria stelleri*," says that he had been told by European pilots at Shanghai that they had often seen seals basking on some islands called "the Ruggeds" at the mouth of the Yangtze. This habit, and the fact that the pilots called them seals rather than sea-lions, makes it seem likely that these were hair-seals and not eared seals. Apparently they are not commonly seen, but one would expect to find them about the mouths of rivers.

Specimens examined:—None.

CHAPTER IX

ORDER CETACEA

WHALES, DOLPHINS, PORPOISES

THE discovery of primitive Cetacea in the Eocene deposits of Egypt, having teeth which in number and structure resemble those of Creodonts or early Carnivora, seems to point unequivocally to the derivation of this order from the latter through the perfection of the bodily structure for a wholly aquatic life. The earlier members of the order had teeth of two sorts, simple peg-like incisors and double-rooted posterior teeth with compressed serrate crowns. In the modern descendants, the teeth tend to be strictly peg-like, and single-rooted, though in a few some traces of the cuspidate crown can be found. Cetaceans have lost practically all their hairy coat, though considerable traces of it may be discovered in some; they have developed a thick outer layer of fat or blubber to take its place as a non-conductor of heat. Their form has become fish-like and their nostrils have shifted to the summit of the head and developed valves for shutting out water when submersed; their fore limbs have become modified into thin elongate paddles which are so stiff as to be of little use except as balancers, while their hind limbs have vanished entirely except for a vestige of the femur in a few species, and vestigial pelvic bones, both buried deep in the posterior muscle masses of the abdomen. The tail, however, has enormously enlarged and is provided at its tip with two lateral lobes or flukes by whose up and down motion the body is propelled smoothly and speedily along. Cetaceans must breathe air like other mammals, for which they rise to the surface at intervals, and refresh their lungs with a new supply. The "spout" is the vapory breath driven out under compression of the lungs, and rendered momentarily visible as it cools and its moisture condenses into a fine spray. The living whales may be grouped in two divisions, the toothed species or Odontoceti, and those provided with ranks of whalebone plates or baleen hanging from the roof of the mouth, comprising the Mystacoceti or whalebone whales, in which the teeth have been lost through degeneration and the matted mass of frayed whalebone fibers serves instead for sieving their food from the water.

Popular terminology for members of this group varies much, but in general the largest species are "whales," the smaller types with rounded heads and short beaks are "porpoises," while those with longer, narrow snouts are "dolphins." Nevertheless, "porpoise" and "dolphin" are often loosely applied. Like the seals, the cetaceans of the Chinese coasts are not well ascertained, but the number will doubtless eventually be found to be two or three times that here enumerated, for many genera are widespread in the Pacific and are seldom brought in by fishermen or found stranded upon the shore.

Of the toothed whales, or Odontoceti, at least three families occur: (1) the primitive Iniidæ, known by a single species lately discovered in the great freshwater lake, Tungting; (2) the Delphinidæ, comprising most of the living porpoises and dolphins, the modern descendants of a group of very diverse forms that flourished in the middle Tertiary times; and (3) the Physeteridæ, represented by the largest of the Odontocetes, the Sperm Whale. The known species of Chinese whalebone whales, or Mystacoceti, as yet probably include but two or three of the several that must eventually be found to occur. These are Finback Whales of the family Balænopteridæ, characterized by short baleen, the presence of many lengthwise furrow-like plaits of extensile muscular tissue on the throat, and by the presence of a projecting cartilaginous "fin" of varying size on the lower back.

KEY TO FAMILIES OF CHINESE CETACEA

A. Teeth present in the jaws..... Suborder Odontoceti.
  a. Teeth in both upper and lower jaws functional.
    a′. Rostrum long and narrow, teeth with broad compressed roots..... Family Iniidæ
    b′. Rostrum short or tapering, teeth with peg-like roots..... Family Delphinidæ
  b. Large functional teeth in lower jaw only; head truncate terminally..... Family Physeteridæ
B. Teeth absent; two ranks of whalebone plates depending from the palate..... Suborder Mystacoceti, Family Balænopteridæ

SUBORDER ODONTOCETI

TOOTHED WHALES

Family INIIDÆ

RIVER DOLPHINS

The River Dolphins are at present known from the Amazon and Orinoco Rivers in the New World and from Tungting Lake in China, a most interesting relict distribution. Their fossil remains are known from middle and late Tertiary formations in both North and South America, implying a former wide

distribution, so that the discovery of *Lipotes*, a living genus of the family in southern China, is of remarkable interest.

The family differs in many details of the skeleton from the true dolphins, to which there is an outward resemblance in bodily form. The cervical vertebræ are all separate, a primitive trait. The jaws are produced into a long narrow beak, with many teeth in each jaw; the lower mandibles are fused, or at least closely appressed, for the greater part of their length, forming a very long symphysis; the upper teeth are confined to the maxillary, and their roots are peculiar in being compressed from side to side and expanded at their base. The rather square posterior part of the skull and the long squamosal processes are rather characteristic also.

The single genus, *Lipotes*, representing this family in China, was discovered so recently as 1918, and is characterized by Miller (1918) as follows:

Genus **Lipotes** Miller

Lipotes Miller, Smithsonian Misc. Coll., vol. 68, no. 9, p. 2, 1918.

Beak long and slender, bowed upward, the basicranial axis not conspicuously bent at an angle to the axis of the beak, mandibles joined for about half their length, the tooth row continuing nearly a third of the distance beyond toward the condyle; teeth about 130 in number, their crowns slightly ridged or furrowed, their roots compressed from side to side and expanded distally. A dorsal fin present.

218. **Lipotes vexillifer** Miller

CHINESE RIVER DOLPHIN; "PEI C'HI"

Lipotes vexillifer Miller, Smithsonian Misc. Coll., vol. 68, no. 9, p. 2, 1918.

Type specimen:—The type consists of the skull, slightly broken in the pterygoid region, and the cervical vertebræ of an adult male, No. 218293, U. S. National Museum, from Tungting Lake, Hunan, China; collected February 18, 1916, by Charles M. Hoy.

Description:—Externally this dolphin, as shown by the published figures, has much the usual dolphin shape, with a very long beak-like snout, gently rounded forehead, narrow pectoral limb, and a low triangular dorsal fin, placed far back and having a long base and nearly straight sides. The caudal peduncle is apparently rather short and deep. In color the skin is pale blue-gray above, white below. According to Pycraft, who examined a complete specimen, it is blind, or at least nearly so, for the eye is very small and degenerate.

Measurements:—Miller states that the length is about 2.5 meters. He gives the following dimensions of the type skull: condylobasal length, 514 mm.; basal length, 510; tip of beak to nares, 390; breadth of beak between maxillary

notches, 96; breadth of beak at middle, 37; greatest breadth of intermaxillaries proximally, 62; occipital depth, 114; temporal fossa, 110 x 80; length of mandible, 471; length of symphysis, 225; upper tooth row, 278; lower tooth row, 285.

Occurrence and Habits:—Hitherto this dolphin has been taken only in the large Tungting Lake, some six hundred miles up the Yangtze, and in the adjacent parts of the river. All that is known of its habits is the brief paragraph supplied by Hoy in Miller's paper, and the note published by Hoy himself (1923) a few years later. He says that in several years' residence he had never seen the species except in the lake and around its mouth. In winter, when the waters of the lake are low, they are more easily seen, for there is scarcely more than the main river channel left for them. At such times they often appear in numbers, usually in little companies of three or four, or at times in schools of as many as ten or twelve individuals. "In summer the water rises to a height of 48 feet above its winter level. The mountain streams feeding the lake are then full, and the dolphins disappear. The natives say that in the late spring when the lake is rising the dolphins make their way up the small, clear rivers, and that these are their breeding grounds." They are fish-feeders, and apparently the long slender beak and practically blind condition are associated with probing about for fish in muddy water, as in the case of the Ganges Dolphin. Hoy states that the stomach of the type specimen contained about two quarts of an eel-like catfish and that the dolphins are "often seen in shallow water working up the mud in their search for fish." The one he collected weighed 297 pounds, and when shot gave vent to a "subdued bellow." The Chinese consider the blubber of medicinal value. Hoy adds that in the Shanghai Museum are two skulls of this species that have been there a long time; one is complete, the other is merely the lower jaw, both without data. In addition to these specimens, one was secured for the American Museum of Natural History by Mr. Clifford H. Pope, at Tungting, through the local fishermen. An excellent photograph, showing the dorsal aspect of the dolphin, was published in connection with Mr. Pope's narrative of his work, in Volume I, plate CX, of this series of reports. In addition to photographs, and color sketches, the skeleton (Amer. Mus. Nat. Hist. No. 63975) and some of the soft parts were preserved, and a life-sized model has been prepared for the Museum's Hall of Ocean Life (see Pope, C. H., in Andrews, "The New Conquest of Central Asia," p. 475, 1932).

Specimens examined:—One, the type.

Family DELPHINIDÆ

DOLPHINS AND PORPOISES

This family contains most of the modern species of small cetaceans.

There are in general two types: those with longer beak-like snouts, to which the term dolphin better applies, and those with abruptly rounded foreheads and very short beaks, to which the term porpoise may be restricted. They are numerous in species in the Pacific Ocean, but only a few are as yet definitely recorded from Chinese waters. Most of the genera have a well-developed dorsal fin, but in some this is lacking; the symphysis of the jaws is usually short, even in those with long beaks, while the teeth are usually simple and peg-like without the expanded roots seen in the river dolphins. The neck vertebræ are more or less fused together in the typical subfamily. The skull has a globular brain case, well rounded posteriorly instead of squared, and the zygomatic process of the squamosal is relatively short.

Of the many genera of this family, only five appear to be definitely known from China, but others certainly occur, such as the common Ocean Dolphin (*Delphinus delphis*) and the Killer Whale (*Orcinus orca*), cosmopolitan species, the former especially in rather warmer waters, the latter in all seas, especially in the North Pacific, where they prey largely on young fur-seals. In the following key, I have included these two genera for convenience.

KEY TO GENERA OF CHINESE DELPHINIDÆ

A. Beak long, a well-developed dorsal fin present.
  a. Color whitish; beak tapering, teeth about 32 on each side in each jaw; symphysis of mandible long, pterygoid bones not touching in the midline.. *Sotalia*
  b. Color dark, symphysis of mandible short, pterygoid bones in contact in midline.
    a′. Body with a dark saddle-mark and indistinct stripes on sides, smaller, teeth 46-50 on each side of each jaw..... *Delphinus*
    b′. Body uniformly dark above, white below; larger, teeth about 25 on each side in each jaw..... *Tursiops*

B. Beak very short or lacking.
  a. No projecting dorsal fin; teeth with compressed crowns; color black, size small, about four feet..... *Neomeris*
  b. Dorsal fin prominent; teeth conical.
    a′. Teeth usually confined to lower jaw in adult, less than ten in all; color grayish, paler below..... *Grampus*
    b′. Teeth in both jaws, about ten in each.
      a″. Color all black, body slender, pectoral fin long and narrow..... *Globicephala*
      b″. Black color interrupted by a pale mark above eye, and another behind the high dorsal fin, belly white, pectoral fin broadly oval.. *Orcinus*

Genus **Sotalia** Gray

Sotalia Gray, Cat. Seals and Whales Brit. Mus., p. 393, 1866.

The members of this genus are still very imperfectly known. In external form they have a dolphin-like appearance, with long, narrow beak, slightly

rising forehead, and a large, more or less triangular or falcate dorsal fin. The color is usually pale, white or gray, in at least one species, speckled. The skull differs from that of other dolphins in the rather long symphysis of the jaws, and in the widely separated pterygoid bones which do not close together behind the palate. The teeth are smooth, peg-like, and number up to 35 on each side of each jaw.

Dolphins of this genus frequent shore waters in the warmer parts of the globe, and are to some extent fluviatile, coming into the mouths of rivers, or as in the case of the Amazonian species, ascending a long distance from the mouth. The following species is the only one known to occur in Chinese waters.

219. **Sotalia chinensis** (Osbeck)

CHINESE WHITE DOLPHIN

Delphinus chinensis Osbeck, Voyage to China and East Indies, tr. by J. R. Forster, vol. 2, p. 27, 1771.
Delphinus sinensis F. Cuvier, Hist. Nat. des Cétacés, p. 213, 1836.
Sotalia sinensis Flower, Proc. Zool. Soc. London, 1883, p. 513.

Type specimen:—None. The name was given by the Swedish missionary and traveler, Peter Osbeck, who while lying at anchor in Canton River, saw "snow-white Dolphins (*Delphinus chinensis*)" tumbling about the ship; he adds that "at a distance they seemed in nothing different from the common species, except in the white colour." The name so informally given might well be disregarded and considered unidentifiable, were it not that there is an essential description pointing out that these resemble the common dolphin and are white. Since later comers have found these same white dolphins in the coastal waters of southern China, and have secured specimens, there can be no doubt whatever that Osbeck's species was the same.

Description:—The color of the live animal is said to be "of a milky white, with pinkish fins and black eyes."

The skeleton is known only from the classic paper of Flower (1870), where it is described in some detail and beautifully figured. The total length was 7 feet 4.5 inches as mounted. It is characterized by the relatively small number of vertebræ, seven cervicals, twelve dorsals, ten lumbars, twenty-two caudals, or fifty-one in all. The bodies of the vertebræ are longer than in related genera and the transverse processes short.

The skull, with the long narrow rostrum, is at once noticeable for the long symphysis of the lower jaw and the widely separated pterygoid bones.

Measurements:—Flower gives the principal cranial dimensions as: greatest length, 20.7 inches; length of rostrum, 12.8 inches; greatest breadth at post-

orbital processes, 8.8; breadth of rostrum at base, 4.7; length of mandible, 18 inches; length of symphysis, 5.5; upper tooth row, 11.2 inches; lower tooth row, 11 inches.

Occurrence and Habits:—This is a species of the coasts and estuaries of southern China, but almost our entire knowledge of it in print consists of the paragraph written by Swinhoe (1870c, p. 652) and his further notes in letters quoted by Flower. Briefly, he tells us that this is a species of daily occurrence in the harbor of Amoy, where they appear to be found throughout the greater part of the year. The Chinese, however, seldom capture them, and it was only with some effort that he finally secured a specimen through a fisherman. This was taken at Quemoy, a large island to seaward of Amoy, and the skeleton sent to the Royal College of Surgeons. Later, writing from Hongkong to Flower, Swinhoe says he believes he has seen this species in the Canton River and the Foochow River and that they were seen seven hundred and fifty miles up the Yangtze as far as Hankow. He adds (1870c, p. 652): "Above that port, and on to Ichang (1110 miles from the sea) we noticed a smaller and apparently different form, also white in colour." This was possibly the River Dolphin, *Lipotes*. A Chinese anatomist, Chi Ping (1927b) has lately contributed an article on the anatomy of the tongue in this species.

Specimens examined:—None.

Genus **Delphinus** Linnæus

Delphinus Linnæus, Syst. Nat., ed. 10, vol. 1, p. 77, 1758.

The genus *Delphinus*, containing the typical Ocean Dolphin, is undoubtedly of frequent occurrence in Chinese seas, and especially is to be looked for in the warmer waters and in the northward flowing Japanese current. As yet, however, no actual specimen is on record from the area. Although several species have been described, most of them appear to be synonymous with the common Dolphin, *Delphinus delphis*. True (1889), however, inclined to recognize *D. longirostris* of the Malabar coast as possibly valid. In color the common Dolphin has a conspicuous dark saddle-shaped area over the back, bordered below by an indistinctly outlined fulvous band becoming gray posteriorly. The ventral surface is white. Flipper black. Eye surrounded by a narrow black ring that extends forward to the base of the beak. Dorsal fin high and falcate. The skull is characterized by the long slender beak, the pterygoids in contact below the posterior nares, and especially by the two long wide grooves one on each side of the midline of the palate. Teeth small, conical and numerous, numbering about 47-50 on each side of each jaw. The total length is about seven feet when adult.

Genus **Tursiops** Gervais

BOTTLE-NOSED DOLPHINS

Tursiops Gervais, Hist. Nat. des Mammifères, vol. 2, p. 323, 1855.

This genus includes several rather similar-appearing species, but in general they are of fairly large size, running to ten feet in length, of rather stout build, with prominent beak, and falcate dorsal fin. Their color is a uniform brownish gray above, shading into white below, the teeth 22 to 25 on each side of each jaw, proportionally large and plump, conical, and adapted for a fish diet. They occur in the warmer seas of the world, and one species at least, the common one of the Atlantic Ocean, is definitely migratory, passing in early summer from the latitudes of the southern United States to the Greenland Sea. These are social dolphins, traveling together in small schools, and frequently accompanying vessels for short distances. The best-known species, *T. truncatus* (Montagu), is believed to be cosmopolitan, and it can hardly be doubted that some member of the genus will be found to occur in Chinese waters. One species, *T. catalania* (Gray), is indeed reported from "China Seas," a skull, No. a3070, in the Muséum d'Histoire Naturelle at Paris, but the precise locality is unknown (True, 1889, p. 41). It is smaller than *T. truncatus*, with a relatively longer beak, and the under surface of the body is spotted. The Paris skull was measured by True as follows: total length, 436 mm.; length of beak, 254; breadth of beak at base of maxillary notches, 109; breadth across intermaxillaries at proximal end, 76. Definite records for this genus in Chinese waters are to be expected.

Genus **Neomeris** Gray

Neomeris Gray, Zool. Voy. H.M.S. "Erebus" and "Terror," vol. 1, Mamm., p. 30, 1846. Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 655, 1925.

Meomeris Gray, List Osteol. Specimens Brit. Mus., p. 306, 1866. Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 676, 1922; *ibid.*, vol. 16, p. 655, 1925.

Neophocæna Palmer, Proc. Biol. Soc. Washington, vol. 13, p. 23, 1899.

The obvious external feature of this genus is the lack of a dorsal fin, its place being taken by a low projecting ridge. The size of the only known species is small; there is no beak or projecting snout, but the forehead rises almost vertically from the upper lip. The eyes are well developed. The skull is characterized by the widely separated pterygoids as in *Phocæna*, and, as in the latter, there is a small hump-like projection of the intermaxillæ at the base. The rostral portion of the skull is bent downward at a very strong angle to the basicranial axis. The teeth vary slightly in number in each jaw, with usually about 15 to 21 on each side of each jaw. The intermaxillary carries one or two minute pointed teeth, but most of those in the remaining part of the tooth row have somewhat spade-shaped crowns, compressed from side to side, and show-

ing a slight nick on the edge in the middle, while those of the lower jaw correspond.

Thomas in 1922 had advocated that *Meomeris* be used for this genus, believing that *Neomeris* was preoccupied for a genus of polyps, and that *Meomeris*, apparently a misprint, was valid, since a genotype was designated. Palmer had already proposed instead the name *Neophocæna*. Apparently, however, as Thomas later pointed out, the previous use of *Neomeris* proves to have been for a plant, so that its use in zoölogy is not invalidated, and it becomes reinstated for this porpoise.

220. **Neomeris phocænoides** (G. Cuvier)

BLACK FINLESS PORPOISE

Delphinus phocænoides G. Cuvier, Règne Anim., ed. 2, vol. 1, p. 291, 1829.
Delphinapterus melas Temminck, in Siebold, Fauna Japonica, Mamm. (aperçu gén.), p. 7, 1842.
Delphinus melas Temminck, in Siebold, Fauna Japonica, Mamm. (mamm. marins), p. 14, pls. 25, 26, 1844-45.
Neomeris phocænoides Gray, Zool. Voy. H.M.S. "Erebus" and "Terror," vol. 1, Mamm., p. 30, 1846.
Delphinapterus molagan Owen, Trans. Zool. Soc. London, vol. 6, p. 24, 1869.
Neomeris kurrachiensis Murray, Ann. Mag. Nat. Hist., ser. 5, vol. 13, p. 351, 1884.

Type specimen:—The type is a skull, No. a3086, in the Muséum d'Histoire Naturelle at Paris. This, although labeled as from the Cape of Good Hope, almost undoubtedly was from a more northern locality, probably from the Malabar coast, as was a second specimen secured at the same time, and also in Paris.

Description:—This small porpoise may be at once recognized by its abruptly rising forehead and the extremely low ridge in place of a dorsal fin, combined with the all-black color.

The skull is characterized by its globose brain case, the short broad rostrum, bent sharply down from the line of the basicranial axis, the widely separated pterygoids, and the teeth, which, usually about 18 to 20 in each tooth row, have the crowns spatulate except in the first few anterior teeth which are smaller and conical.

A more extended account of five skeletons and their variations was published by the writer in 1923, from which it appears that a vestigial pair of ribs is normally present in connection with the seventh cervical vertebra. The thoracic ribs are usually thirteen pairs, though one case of fourteen is recorded. Compared with *Phocæna*, the head is more rounded, the pectoral fin more attenuate, the rostrum shorter and more deflected downward, correlated perhaps with bottom feeding, the three anterior cervicals are fused, the neural spines of the body vertebræ are less developed, the posterior portion of the sternum is reduced, and the humerus is proportionally longer. For an excellent account of the muscular anatomy in a Chinese specimen, see A. B. Howell, 1927b.

Measurements:—The largest of the four specimens secured by Dr. F. R. Wulsin were two males, measuring 1,580 and 1,460 mm. respectively, or 62.5 and 57.75 inches. The other recorded measurements are smaller, and it may be that females average a little smaller than males. At all events two females with each an embryo, measured 47 and 50 inches respectively. An adult female, sent whole in preservative, by Dr. Wulsin, measured: snout to notch of flukes in a straight line, 1,245 mm.; to front of dorsal ridge ("fin"), 585; snout to anus; 850; to insertion of pectoral fin, 230; to eye, 80; to angle of mouth, 50; to posterior edge of blow-hole, 90; width across flukes of tail, 430; greatest length of pectoral fin, 265; its width, 85.

The measurements of five skulls are given in my paper of 1923 (p. 248). The largest of these gives the following: greatest length, rostrum to foramen magnum, 220 mm.; rostrum to maxillary notch, 91; rostrum to front edge of blow-hole, 124; palatal length, 127; greatest width, 156; width of rostrum at maxillary notches, 79; length of upper tooth row, 75; lower tooth row, 71; length of mandible, 170.

Occurrence and Habits:—This is a strictly coastwise, estuarine and fluviatile porpoise, frequenting the shores in warmer waters, from the coast of western India around to southern Japan. It enters the mouths of the larger rivers, and ascends the Yangtze as far up as the Ichang Gorge, whence the British Museum has received a specimen (Lydekker, 1909d). Although the published records of the species are few, it is known from various localities on both sides of the Indian peninsula, Singapore, and Strait of Malacca, and is said to occur also in Bornean waters. In China, it is apparently common at the mouth of the Yangtze, where Sowerby (1926c) writes that they are often seen in schools "playing at the surface." He mentions one captured in the Whangpu, where it is fairly common in Seven-mile Reach above Shanghai, and states that the color in life is dark slate gray with a little white about the lips. Apparently these porpoises pass freely up the great river, reaching not only Ichang on the main stream, but also occurring commonly at Tungting Lake, the haunt of *Lipotes* (Hoy, 1923). Dr. F. R. Wulsin, who secured the specimens now in the Museum of Comparative Zoölogy, obtained three of these in a small tributary of the Yangtze coming in near its mouth at Kiangyin, Province of Kiangsu, eighty miles above Shanghai. Here the Chinese capture them by suspending a number of sharp iron hooks from a long line stretched across the stream at the surface of the water. In passing up and down, a porpoise eventually strikes one of these hooks, and its struggles to free itself only serve to entangle it the more firmly among the neighboring hooks, until it is drowned or killed. In the museum of the Royal Asiatic Society at Shanghai is a mounted skeleton of this species (Sowerby, 1926c). Dr. Wulsin's

fourth specimen was captured in a fresh-water stream that flows into Tungting Lake, Hunan, one hundred and twenty miles south of Yochow. The specimens on which A. B. Howell's (1927b) paper was based came from Kiangsu, five from Woosung and two from Whangpu, in addition to an eighth from some other point on the Yangtze. These are in the U. S. National Museum. Like the Harbor Porpoise, these small cetaceans are said not to leap out of water, but are rather sluggish in their movements, rolling to the surface for breath. Their chief food seems to be shrimps, *Palæmon japonicus*, a species found in the Yangtze as well as in the neighboring seas. Remains of this shrimp were identified by Dr. Waldo S. Schmidt of the U. S. National Museum, as well as the spinal cords of two small fishes, among the stomach contents of one of Dr. Wulsin's specimens. Similar food and in addition the remains of small squids have been recovered from stomachs of Indian examples. Sowerby states that the Chinese name for this porpoise is "hai-chu" or Sea Pig.

Specimens examined:—Four, as mentioned above:
Kiangsu: Kiangyin, 3 (M.C.Z.).
Hunan: Lake Tungting, 1 (M.C.Z.).

Genus **Grampus** Gray

Grampus Gray, Spicilegia Zool., p. 2, 1828.

This genus appears to contain but a single cosmopolitan species, for, although several have been described from the different oceans of the world, True (1889), who examined the evidence very carefully, came to the conclusion that the characters claimed for these were matters of individual variation. In form the Grampus resembles the Blackfish rather closely, having rather narrow pectoral fins or "flippers," a large falcate dorsal fin, and the forehead rising abruptly in a convex curve. The skull differs in having the area in front of the nostrils elevated, while the teeth are deciduous, ordinarily lacking in the upper jaw, and gradually becoming lost, with age, in the lower, although when all are present there are as many as seven on each side of the mandible.

221. **Grampus griseus** (Cuvier)

THE COMMON GRAMPUS

Delphinus griseus Cuvier, Ann. Mus. d'Hist. Nat., Paris, vol. 19, p. 14, pl. 1, fig. 1, 1812.
Globiocephalus rissi Anon., Chinese Repository, vol. 6, p. 411, 1838.
Globicephalus rissoi Blyth, Journ. Asiatic Soc. Bengal, vol. 28, p. 481, 1859.
Globiocephalus chinensis Gray, Cat. Seals and Whales Brit. Mus., p. 323, 1866.

Type specimen:—Not specified.

Description:—The general color is "a steel gray of medium depth and everywhere uniform. The lower lip and chin, the margin of the upper lip, and an area on the belly beneath the dorsal fin are of a light gray color, ap-

proaching white. The whole body and the fins are traversed by irregular lines of a light gray color and of varying width and length" (True, 1889, p. 126).

The skull has a relatively short rostral portion, its length less than that of the remainder of the skull, and tapering conspicuously forward; the intermaxillaries are wide and of nearly uniform length throughout, with their rostral portion convex upward. The teeth are usually confined to the lower jaw, and even these drop out with age. Seven on each side seems to be the maximum number recorded.

Measurements:—True gives the following for a large female from the coast of New England: length in a straight line, 130 inches; tip of snout to eye, 15 inches; tip of snout to blow-hole, 17 inches; tip of snout to anterior base of pectoral fin, 22 inches; tip of snout to anterior base of dorsal fin, 50 inches; length of pectoral fin, 21.5 inches.

The skull measured (True, 1889, p. 128): greatest length, 487 mm.; length of rostrum, 246; greatest breadth across zygomatic processes of squamosals, 342; breadth across antorbital processes of frontal, 310; breadth of rostrum at base, 204.

Occurrence and Habits:—As elsewhere, in the oceans of the world, this is a rather uncommon species, or at least it appears so, in that seldom are more than one or two individuals taken at one time. The sole record for China is the oft-quoted one in the Chinese Repository of January, 1838, of a male taken at Leuchen, and described as black above, lighter on the belly, with a triangular dorsal fin, and but five blunt and worn teeth in the lower jaw only. The total length is said to have been 9.75 feet, that of the pectoral fin 14 inches. So far as known, the food consists of squid and cuttlefish, a diet that in other cetaceans seems to be correlated with the degeneration of the teeth, particularly of the upper jaw.

For an excellent photograph, showing the curious linear and circular markings, and external form, see an article by Troughton in Proceedings of the Zoölogical Society of London, p. 565, pl. 1, 1931, concerning a male and a female stranded at Sydney, New South Wales.

Specimens examined:—None.

Genus **Globicephala** Lesson

BLACKFISH

Globicephala Lesson, Hist. Nat. Mamm. et Ois. decouv. depuis 1788, vol. 1, p. 441, pl. 8, 1828.
Globiocephalus Gray, List Mamm. Brit. Mus., p. xxii, 1843.

The Blackfishes are rather closely related to the Grampus, but there is a slight indication of a beak usually present in the shape of protruding lips, whereas in Grampus the forehead rises almost vertically without any pro-

jection. The body is longer and more slender, and the pectoral fin much narrower and attenuate. In the skull the rostral portion is broad and bluntly rounded in front, the intermaxillæ in some species broad, the pterygoid bones in contact along their median line. The teeth are moderately large and relatively few in number, only eight in each row in the species considered here.

It is not certainly known what is the species occasionally seen in Chinese seas, but since *G. scammonii* was obtained by Dr. Andrews at one of the Japanese whaling stations, it is assumed that the same one occurs in Chinese waters.

222. **Globicephala scammonii** (Cope)

SCAMMON'S BLACKFISH

Globiocephalus scammonii Cope, Proc. Acad. Nat. Sci. Philadelphia, 1869, p. 21. True, Bull. U. S. Nat. Mus., no. 36, pp. 139, 185, 1889.

Type specimen:—True (1889, p. 139) remarks that "this species was made known by Professor Cope from the description, measurements, and drawings of Scammon." There is in the U. S. National Museum a skull presented by Scammon which True says "is presumably the type of the species," but, since no type was named, this is presumptive merely.

Description:—This Blackfish belongs to a group of world-wide distribution in warmer waters of the globe, in contrast to the North Atlantic species, *G. melæna*. It is outwardly distinguished by its long slender body, the very narrow and elongate pectoral fin, large crescentic dorsal fin, with its concavity pointing backward, and by its entirely black color, lacking the white median areas below of the other type.

The skull is distinctive, on account of the very widely expanded intermaxillaries, which in this type practically cover the entire breadth of the rostrum at its tip, and so are much wider than in the *melæna* type. Moreover, the teeth are fewer, seven or eight in a row.

Measurements:—According to Scammon (Marine Mammals), the total length of a male was 186 inches (4,724 mm.); from tip of snout to dorsal fin, 54 inches (1,372 mm.); tip of snout to pectoral fin, 33 inches (838 mm.); length of pectoral fin, 34 inches (864 mm.); breadth across flukes, 42 inches (1,067 mm.).

True (1889, p. 185) gives the following measurements for the skull in the U. S. National Museum: total length, 690 mm.; length of rostrum, 340; breadth of rostrum at base, 308; breadth between orbits, 487.

Occurrence and Habits:—The reference of Blackfish reports from Chinese waters to this species is wholly provisional. Indeed, the validity of the species *G. scammonii* is rather doubtful, since it is very closely related to the species

of the warm waters of the Atlantic, and other names applied to what is apparently a Blackfish from Japanese waters may eventually be found identifiable when more is known of the characters of these cetaceans. Blackfish at sea may usually be identified by their rather leisurely movements, rising to "blow" with an easy grace, showing the backwardly pointed dorsal fin, much rounded forehead, and at favorable opportunities the long narrow pectoral. The length of the body is such that it is in sight an appreciable time when the animal breaks water to breathe, and it sometimes leaps out of water partly, churning up foam. They are gregarious, often gathering in large schools, up to several hundreds or more. In his work at the Japanese whaling stations, Dr. Andrews found that this species was occasionally taken, and it is perhaps the same one that has been seen in Chinese waters. The examination of actual specimens, however, is most highly desirable to establish this.

Sowerby (1926h, 1927) has published two brief notes on the presence of cetaceans, supposed to be Blackfish, off Shanghai. The first of these relates to an enormous school reported by Captain W. E. Kent on September 2, 1926, off Gutslaff Island at the mouth of Whangpu, Yangtze estuary. As far as the eye could see, there were hundreds, "breaching" and swimming about. They turned north and east later, and disappeared to open sea. The second note mentions a school of seventy or eighty, seen by Mr. Arthur L. Anderson from his yacht anchored in the Yangtze estuary near Shanghai.

Specimens examined:—None.

Genus **Orcinus** Fitzinger

KILLER WHALE

Orcinus Fitzinger, Wiss.-Pop. Naturgesch. der Säugethiere, vol. 6, p. 204, 1860.
Orca of authors is preoccupied for another genus of cetaceans, as a synonym of *Hyperoodon*.

The Orca is characterized by its stout body, lacking any indication of a beak, a high dorsal fin in the male, skull with a long rostrum, the intermaxillaries not broadened at the tip, pterygoids in contact, the teeth very stout and about ten (rarely to twelve) in each row. Since this cetacean, the largest of the Delphinidæ, is important as an enemy of the fur-seal, and because of its cosmopolitan distribution, it may be here included for the sake of reference, although I have no actual records from China.

223. **Orcinus orca** (Linnæus)

KILLER WHALE; ORCA

Delphinus orca Linnæus, Syst. Nat., ed. 10, vol. 1, p. 77, 1758.
Orcinus orca Fitzinger, Wiss.-Pop. Naturgesch. der Säugethiere, vol. 6, p. 204, 1860. Palmer, Proc. Biol. Soc. Washington, vol. 13, p. 24, 1899.

Type specimen:—Not known to exist.

Description:—As seen in life, the coloring above is blackish or grayish black, with a whitish, narrowly oval mark behind the eye and a more obscure whitish patch just below and behind the dorsal fin, forming a saddle mark, broadest medially and tapering downward and forward. In some individuals this mark is more clearly noticeable than in others, and both light areas are said sometimes to be yellowish. The mid-ventral region is white, sharply outlined, this area narrowing between the pectoral fins, expanding posteriorly to take in the lower parts as far as the anus, and continuing in an upward- and backward-reaching arm.

The skull is rather more solidly built than in related genera; the rostrum is fairly long, not short and rounded as in the Blackfish. The teeth are large, stout, conical, and sharp-pointed. They project somewhat laterally, and are usually about ten in number in each row, though in some specimens as many as twelve may be counted.

Measurements:—There is a remarkable sexual difference in size and proportions in this cetacean. The males not only attain a larger size, but the dorsal fin in this sex becomes enormous, a huge triangular affair with practically straight edges, while the pectoral fin broadens out with age, becoming almost oval. In the female, the dorsal fin is large but hardly more than a third as high as in the male, and falcate, while the pectorals are narrower. Males reach a length of about 26 feet, possibly thirty, but this latter was "estimated" only; females are much smaller, rarely exceeding 15 feet in length. The form is stout and heavy, and the forehead slopes backward from the tip of the snout, so that there is no beak. An adult skull from the Pacific (M.C.Z. 1205) measures: greatest length, 950 mm.; length of rostrum to maxillary notches, 510; palatal length, 620; greatest width, 630; width of beak at base, 290; upper tooth row, 355; lower jaw, length, 770; lower tooth row, 360.

Occurrence and Habits:—No definite records of the Orca are at hand for Chinese waters, but there is no doubt that it occasionally passes along the coasts, for it is a cosmopolitan species, found in all the oceans of the world. In the North Pacific it is well known to be common on the American side, and during the summer is one of the chief enemies of the fur-seal, which it very likely harries also in its wintering places in the Japanese waters. It is a most voracious animal, going in small schools and often attacking the whalebone whales or snapping up small porpoises. Both fur-seals and hair-seals know it as a dangerous enemy, and where possible will scramble out on land or hide when a drove of them appears.

Specimens examined:—None.

Family PHYSETERIDÆ

SPERM WHALES

This family is distinguished in part by the fact that the maxillaries are extended upward at the sides of the skull, so that an enormous basin is formed for the support of a large reservoir-like "case" containing nearly pure spermaceti, a thick oil, which may be dipped out, of the consistency of tallow. This remarkable enlargement of the anterior end of the head gives it a characteristic appearance, and it is more or less vertically truncate or square in front. The functional teeth are confined to the lower jaw. There are two living genera, *Physeter*, the Sperm Whale, largest of the Odontoceti, and the much smaller *Kogia*, or Pygmy Sperm Whale. In the former the nostril or blow-hole is situated at the tip of the snout asymmetrically on the left-hand side, while in *Kogia* it is nearly median at a distance back from the snout as in the cetaceans generally. Sperm Whales doubtless reached the Chinese seas in times gone by when they were not assiduously hunted, but during the height of the sperm-whale fishery the species became much depleted, though now it has probably slightly recovered.

Genus **Physeter** Linnæus

Physeter Linnæus, Syst. Nat., ed. 10, vol. 1, p. 76, 1758.

The only living species of this genus is the Sperm Whale, of world-wide distribution in especially the warmer seas, though rarely straying well north into colder water. It is distinguishable by the enormous truncate head, asymmetrical S-shaped blow-hole on the left-hand side near the tip of the snout, the enormous basin-like forehead of the skull, long symphysis of the lower jaw, and the large stout teeth, about 25 to 27 in each ramus of the lower jaw. Traces of non-functional small teeth have been reported from the upper jaw.

224. **Physeter catodon** Linnæus

SPERM WHALE

Physeter catodon Linnæus, Syst. Nat., ed. 10, vol. 1, p. 76, 1758
Physeter macrocephalus Linnæus, *ibid.*, and of various authors.

Type specimen:—No type specimen exists. The name was given by Linnæus to the cetacean described by Robert Sibbald as having been cast ashore in the Hebrides. In this case there was a school of them, and the description seems applicable to nothing else than the Sperm Whale, so that the name *P. catodon*, coming first in Linnæus's work, must unfortunately displace the much more familiar *P. macrocephalus* by which the species is almost universally known.

Description:—The enormous head, comprising nearly a third the total length, with the asymmetrical blow-hole on the left side of the snout, the presence of a low ridge-like dorsal fin, and the entirely black color except for a certain amount of white marbling about the lips, suffice to identify this whale.

Measurements:—The adult male reaches a length of fifty feet or slightly over and has an enormous head with overhanging upper lip, squarely truncate snout, and narrow lower jaw with about 25-27 teeth on each side of it. The female is much smaller, about 30 feet, and the end of the snout more rounded, instead of square, while the teeth are more slender and recurved.

Occurrence and Habits:—Undoubtedly Sperm Whales at times enter the China Sea and pass along the coasts of China on their way north in spring, or at least they must have done so in times past. The only actual record seems to be that of Chi Ping (1924) of a "young whale (*Physeter*)" that came ashore at Tinghai, Chekiang. The splendid map prepared by Dr. Charles H. Townsend, showing in color the monthly distribution of Sperm Whales as plotted from over 11,000 records, indicates that in summer this species was common off the eastern coast of Japan, on the so-called "Japan Grounds," as well as farther to the east approaching the Hawaiian Islands. He shows a scattering of winter records for the China Sea and north of the Philippines.

Specimens examined:—None.

SUBORDER MYSTACOCETI

WHALEBONE WHALES

The suborder Mystacoceti includes at least three families of living whalebone whales, in which the teeth are lost by resorption before birth, while a series of whalebone plates is formed, hanging down in two lengthwise ranks into the capacious mouth cavity. The frayed and tangled ends of these plates form a sieve by which the minute crustaceans and small fishes, on which the whales chiefly feed, are strained out before they are swallowed.

The few published records of larger Cetacea for China are of so indefinite a nature that it is almost useless to attempt an identification of them. Probably, however, three families should be expected to occur. These may be identified by the following key, which also gives the obvious generic and specific distinctions.

KEY TO WHALEBONE WHALES TO BE EXPECTED IN CHINESE SEAS

A. Lower back without a triangular projection or fin.

a. Upper jaw and lower lips much arched, whalebone plates very narrow but long, up to seven feet, both the plates and frayed ends black, body thick and black in color, or white-marbled below..... Family Balænidæ, *Eubalæna glacialis* (Bonnaterre), Right Whale

b. Upper jaw and lips slightly arched, whalebone plates short and broad, up to about two feet, dull whitish throughout, body long, tapering, throat with two longitudinal grooves, body color mottled gray..... Family Rhachianectidæ, *Rhachianectes glaucus* (Cope), Gray Whale

B. Lower back with a triangular projection or a well-defined vertical fin..... Family Balænopteridæ, Finbacks

a. Throat with about fourteen lengthwise plaits, dorsal fin a low, irregular projection, pectoral limb very long, about one-third the total length of body, body color black, more or less mottled with white..... *Megaptera nodosa* (Bonnaterre), Humpback

b. Throat with many more than fourteen lengthwise plaits, dorsal fin well-defined, somewhat hooked backward, pectoral limb about an eighth of total length.

a′. Sides of upper jaw tapering evenly to the tip, dorsal fin large, falcate, body white below..... *Balænoptera*

a″. A broad white band across the pectoral fin, length to about twenty feet, whalebone and its frayed ends yellowish white..... *B. acuto-rostrata* Lacépède, Little Piked Whale

b″. Pectoral fin all dark-colored above.

1. Smaller, length to fifty feet, whalebone black, its frayed ends fine and white.... *B. borealis* Lesson, Sei Whale
2. Larger, to sixty-five feet, whalebone dark with many partly or wholly white blades, their frayed ends coarse and dull whitish. *B. physalus* (Linn.), Finback

b′. Sides of upper jaw bowed outward from the tip, dorsal fin small, body bluish to mouse-gray all over except for irregular blotches of white on throat, whalebone and its frayed ends black throughout..... *Sibbaldus musculus* (Linn.), Blue Whale

Although a century or less ago, before the characters of the different species of large whales were well made out, a great many names were applied to members of this group, it now becomes apparent from the work of True, Lönnberg, Harmer, Andrews, and others that the number of distinct species is small, while their characters are subject to a certain amount of variation, so that it becomes increasingly doubtful whether, as was formerly believed, any reliable characters can be found that will satisfactorily distinguish geographical races in the different oceans. Nevertheless, this is not always easy to demonstrate, for very few specimens of Pacific whales are preserved in museums, and because of their size adequate comparisons are difficult even between specimens. In such large animals, too, the range of individual varia-

tion is likely to be proportionate, and can hardly be determined from the limited number of museum specimens. In the lack of anything of a definite nature available, it must suffice here to indicate the species of probable occurrence, with the expectation that if future investigations reveal actual characters distinguishing Pacific from the longer-known Atlantic representatives, the former will prove at best only racially different.

The Right Whale, distinguished by its long narrow baleen plates and arched rostrum for their accommodation, was named *Balæna sieboldii* by Gray, on the basis of supposed characters supplied by the Japanese animal, for it is frequently taken in the seas off Japan. It is altogether uncertain, however, how far it really differs from the Atlantic species, *Eubalæna glacialis* (Bonnaterre).

The Gray Whale, *Rhachianectes glaucus* (Cope), was especially investigated by Dr. Roy Chapman Andrews at the Japanese stations, and in his monograph on the species, he regards it as the type of a family distinct from the Right Whales or the Finbacks. Exteriorly it lacks a dorsal fin, and has but two throat grooves, while its whalebone is pale and coarse. It used formerly to abound in winter along the California coasts, and Dr. Andrews found it as far south as the Japanese coasts on the west side of the Pacific. It is unknown whether or not it occurs in Chinese waters as well, but it may be looked for.

The Finbacks as a group are recognizable by their many longitudinal muscular plaits on the under side of the throat, an adaptation allowing them to engulf a great body of water at a time, which is then expelled through the whalebone strainer, and the small fish or crustaceans contained are left to be swallowed.

The Humpback Whale, *Megaptera nodosa* (Bonnaterre), is remarkable for its very long pectoral limb, nearly a third the length of the entire animal, while at the same time the throat folds are few, about fourteen between the pectoral limbs, and the fibrous "fin" at the lower part of the back is low, and often of irregular shape. This species is fairly easy to capture with harpoons, and in the Atlantic it is found to be somewhat migratory, following schools of small fish northward in summer and retreating somewhat to the southward in winter. This is possibly the species concerning which Swinhoe (1870a, p. 231) wrote that he saw one or two large whales off the west coast of Hainan, and that one was taken there by some fishermen, who tried out the oil, ate the flesh, and ground up the bones for manure. He adds that it seems to winter in these seas, and in May is seen accompanied by its young one in Namoa Straits near Swatow, remaining in those waters until the northeasters set in during late October. He mentions a reference in the Chinese Repository,

of November, 1843, to "Notices of the whale-fishery in the Chinese Seas, as conducted by the Inhabitants of the Coasts" (not seen).

The large Finner Whale that Gray described in 1865 (Proc. Zool. Soc. London, p. 725), from cervical vertebræ sent from Formosa by Swinhoe, was with little doubt the Common Finback Whale, *Balænoptera physalus*, although Gray supposed it to be different, in that the second and third cervicals were partly united, and hence he called it *B. swinhoii*. True's monograph of the species indicates how wide individual variation may be, and there seem no good grounds for supposing that this specimen was more than a variant. Probably this will prove to be one of the most common of the large cetaceans in Chinese waters. Swinhoe states (1870c, p. 652) that in years past some Americans undertook to establish a whale fishery at Swatow but after one or two captures found the whales useless for their purpose and gave it up. No doubt these were some sort of finback, whose thin blubber yields far less than that of the Sperm or the Right Whale, which were probably the ones sought. Licent (1924) mentions that a "whale" went ashore lately at Chefoo, but gives no indication of its species.

Other fin whales common to cooler waters all over the globe will be found in time along the Chinese coasts. Sowerby (1924i) mentions a young one, fourteen feet long, taken at Amoy, and preserved for the Museum at Amoy University. He speaks of it as *Balænoptera ?borealis*, a medium-sized species resembling the Common Finback but smaller, with deep black whalebone, whose frayed ends are fine and wool-like, and contrastingly pure white, while in the latter the whalebone plates are all white, or all dark purplish, or more often streaked lengthwise with narrow white or purplish bands, and their frayed bristly ends coarse and dull whitish. The small *Balænoptera acutorostrata* is common along rocky coasts, often entering bays and coming close in shore. It seldom much exceeds twenty feet in length and is easily identified by its all yellowish-white whalebone and the wide white bar across the pectoral fin. Finally, the Blue Whale, *Sibbaldus musculus*, the largest living mammal, is known to be common at times in the North Pacific and is of cosmopolitan range. Its extreme length in a straight line may exceed 80 feet, or, if one may believe the records, even more. Its head is distinctive with the outwardly bowed instead of nearly straight outlines of the rostrum.

CHAPTER X

ORDER NOMARTHRA

SCALY ANTEATERS OR PANGOLINS

In older classifications the pangolins were regarded as an Old World group of the order Edentata, characterized by their external covering of broad horny scales arranged in regular overlapping series, the small conical head, long extensile tongue, the lack of teeth, and by the great development of the median claws of the fore foot, which can be doubled back against the palm, and serve to break open the nests of termites, for these insects and probably ants as well, form their food. In spite of these similarities to the American anteaters, there are so many and important differences, such as the lack of a clavicle, the difference in articulation of the vertebræ of the lower back, the external genitalia in the male, and others, that current usage assigns them to a distinct order. Nevertheless, Winge is probably correct in regarding both groups as distantly related, perhaps having arisen at a remote period as an offshoot of the Insectivora that became specialized for living upon ants and especially termites (white ants). These insects within the subtropics form an abundant and dependable food supply, so that any animal becoming adapted to live exclusively on them is thereby freed from future uncertainty as to its sustenance. It needs only a specialized claw development to help in securing this food, but other changes have taken place in the loss of teeth, the development of the tongue and salivary glands, and the broad flat tail that serves as a prop when the animal rests on its haunches in digging, or in part to fold about itself as a protection when it curls up, on being disturbed, for it is incapable of much offensive action. Its scaly armor is unique among mammals.

The pangolins are all included in the single family Manidæ, confined to the warmer parts of Asia and of Africa south of the Sahara.

Family MANIDÆ

PANGOLINS

The family has lately been studied by Pocock (1924) who regards the

several distinct types composing it as the representatives of six genera. There are two more obvious modifications: the longer-tailed arboreal types, and the shorter-tailed ground-living forms, of which apparently two species occur in China, assigned by Pocock to two genera, *Manis* and *Phatages*. These may be known by the following characters, based in part on his key.

KEY TO THE GENERA AND SPECIES OF CHINESE NOMARTHRA

A. Median row of scales consisting of a single series quite to the end of the tail; xiphisternum short and spade-shaped, not produced as two long slender rods extending back to the posterior ribs..... Subfamily Maninæ (the Asiatic Pangolins)

a. External ear a well-developed flap; a distinct post-anal depression in the male; nasal bones much wider posteriorly than in front. *Manis pentadactyla*

a′. Size averaging smaller, skull length usually less than 83 mm..... *M. pentadactyla dalmanni*

b′. Size averaging larger, skull length in adults usually exceeding 83 mm..... *M. p. pusilla*

b. External ear a mere thickened ridge; no post-anal depression in the male; nasal bones of practically the same width throughout..... *Phatages crassicaudata*

Genus **Manis** Linnæus

Manis Linnæus, Syst. Nat., ed. 10, vol. 1, p. 36, 1758.
Pholidotus Brisson, Regne Anim. in Classis IX distrib., Quadr., ed. 2, p. 18, 1762.
Pangolin Gray, Hand-list Edentate, Thick-skinned and Rum. Mamm. Brit. Mus., p. 8, 1873.

The general characters have been already indicated. The Asiatic pangolins differ from their African relatives in having the median series of scales continued in single series to the end of the tail, whereas in the latter there is a sudden transition near the tail-tip to a double series. The curious conical skull shows numerous peculiarities, many of them of a primitive sort, such as the large nasals, broadly expanded at the base, the frontals exceeding the parietals in size, the large supraoccipital, and the ring-like tympanic bone; on the other hand, it is specialized in the complete loss of teeth, reduced size of the lower jaw, and in the tubular backward prolongation of the palate. The jugal also has been lost, the orbito-temporal fossa is much reduced through the lack of strong jaw muscles, and the maxillary process and the squamosal are in consequence very nearly in contact. In typical *Manis*, there is a fairly well-marked external ear formed by a narrow flap of skin, but this is reduced in related genera to a mere thickened ridge. A single species only is known, the typical race of which is Formosan, *Manis pentadactyla pentadactyla*. It is represented on the Chinese mainland by a smaller race and by another slightly different form on Hainan.

225. **Manis pentadactyla dalmanni** Sundevall

CHINESE PANGOLIN

Manis dalmanni Sundevall, Kongl. Vet.-Acad. Handlingar for 1842, Stockholm, p. 278, pl. 4, fig. 10, 1843.

Manis aurita Hodgson, Journ. Asiatic Soc. Bengal, vol. 5, p. 234, 1836. Anderson, Anat. and Zool. Researches Western Yunnan, p. 352, 1879.

Manis pentadactyla Cantor, Ann. Mag. Nat. Hist., ser. 1, vol. 9, p. 482, 1842. Cabrera, Bol. Real Soc. Esp. Hist. Nat., Madrid, vol. 22, p. 169, 1922.

Pholidotus kreyenbergi Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 234, 1908.

Manis (Pholidotus) kreyenbergi Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 32, 1922.

Manis pentadactyla dalmanni G. M. Allen, Amer. Mus. Novitates, no. 429, p. 6, 1930.

Type specimens:—When Sundevall described and named *Manis dalmanni*, he based his account on three specimens, giving the habitat as "China, prope Canton." These three specimens, which may be taken as cotypes, were: a skin without rostrum in the Stockholm Museum, which was apparently without label, for Sundevall surmised it might be the same one that Dalmann had written about from Formosa nearly a hundred years before; the second specimen was of unknown origin, in the Copenhagen Museum; the third was in the Muséum d'Histoire Naturelle at Paris, where it had been received a few years previously from China. Since this last was the only specimen of known origin, and since the author expressly states that he is describing the pangolin of the mainland of South China, I would designate it as the lectotype.

The type locality of the race *Manis pentadactyla pentadactyla*, is, as Thomas has shown, to be taken as Formosa, whence Bontius, in 1658, described and figured a specimen that afterward became the basis of this name.

Description:—The large scales completely cover both sides of the tail to its base, but on the head and body the protective armor is on the dorsal side only. The scales may be darker or lighter horn-color, while the hair that sparsely clothes the under surfaces of the body is either grayish white or dull ochraceous in color. A few scattered bristle-like hairs project between the plates of the back, but these soon become worn away. The ear is a well-developed flap. The number of scales in the median line varies somewhat individually but averages about fifteen on the head and neck, seventeen or eighteen on the body, and about sixteen or seventeen on the tail. In the tenth diagonal ring of scales across the body, there are normally fifteen scales.

The skull is smaller than that of the Formosan and the Hainan races, but series of measurements of the former are not available.

Measurements:—According to Swinhoe, the typical race from Formosa is about a third larger than Amoy specimens and is constantly of a larger size than the South China animal. The following measurements were mostly taken from well-made skins and are, therefore, only approximate:

No.	Greatest length	Tail from lower side	Locality
19992 MCZ (in flesh)	810	330	Anhwei
85133	720	295	Fukien
85132	800	320	Fukien
43162	815	285	Yunnan
47851	765	280	Fukien

The average of twelve specimens, including the above, which are the largest, is: length, 712.5 mm.; tail, 273.

CRANIAL MEASUREMENTS OF *MANIS PENTADACTYLA DALMANNI*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Width of brain case	Length of nasals	Greatest width of nasals	Length of lower jaw	Sex	Locality
57060	83.5	76.0	48.5	33.5	35.6	25.5	10.3	54.5	♀	Fukien
85129	81.5	75.5	47.5	31.0	38.0	29.2	11.0	55.2	♀	Fukien
85127	72.0	65.2	41.0	28.7	32.6	25.3	10.0	54.0	♂	Fukien
85134	80.0	74.1	46.5	34.3	36.5	27.0	12.5	54.5	♂	Fukien
85135	76.0	69.0	44.4	31.4	36.8	25.0	10.5	51.0	♂	Fukien
85132	83.0	77.0	47.0	32.3	38.3	31.0	11.6	56.0	♂	Fukien
47851	85.3	78.0	49.5	34.8	38.0	29.5	10.0	58.2	—	Fukien
47854	74.6	68.2	44.0	31.8	36.0	25.3	11.4	52.2	—	Fukien
19992 MCZ	82.0	78.0	49.5	34.0	39.0	27.3	11.4	58.0	—	Anhwei

Occurrence and Habits:—The pangolin is found all over southeastern China, from the southern border northward to southern Anhwei, but does not go beyond the Yangtze valley. It is said to be found also on the island of Chusan, off the mouth of the Yangtze. Inland its range extends southwestward in the Yangtze valley, whence there are records for Kiukiang, Nanking, and Tatung. It does not, apparently, extend even to eastern Szechwan, but avoids the higher country of western China, appearing again in the southern parts of Yunnan. No doubt its distribution is very largely determined by the presence of termites in sufficient quantity to form a dependable food supply. Professor Alfred Emerson, who has made a special study of this group, writes me that six genera of termites are known from China, of which one, *Kalotermes*, lives in hard wood and is doubtless, therefore, unavailable to the pangolins for food. The two abundant species seem to be *Coptotermes formosanus* and *Termes* (*Cyclotermes*) *formosanus*, which are widely distributed over southeastern China, the former as far north as the Yangtze Valley. One species, he writes, *Reticulitermes chinensis*, is reported from Suifu, in southeastern Szechwan. There seems to be a close correlation between the range of the two species first mentioned and that of the pangolin.

Swinhoe (1870c) states that only one embryo was found in the pregnant females he examined, and this is apparently the usual number of young. He

FIG. 20. Distribution Map.
Manis

1. *M. pentadactyla dalmanni* 2. *M. pentadactyla pusilla*

adds that in June, 1867, he purchased an adult female and three little ones at Amoy, but that these young probably were from different parents. They ran about actively and would stand on their hind legs. The Chinese names are said to be "chuen-shan-kia" (or Hill-borer) and "ling-le" (or Mountain Carp) from the fancied resemblance to a carp produced by the scales. Sowerby (1925b, p. 151) writes that their food is termites and the larvæ of ants, but that they will not eat adult ants; the larvæ of bees and wasps are also eaten. Termites are abundant in the country it inhabits, and they often carry their galleries high up in trees. There is also a species of ant that makes huge nests high up in trees, and these the pangolin reaches by climbing with some agility, using its tail in a prehensile fashion, short as it is. The pangolins live in burrows from eight to twelve feet in depth with a large chamber at the end, and will block up the mouth of the hole on returning to it. They are abroad almost altogether by night, and sleep rolled up. The young may be as many as two, but usually one, and they are carried on the mother's back while small. They are born in the spring of the year. Mell (1922) corroborates these observations from his experience in Kwangtung, where they are found everywhere in the hilly country, and in winter are often brought alive to the Canton Market. He found a young one 100 mm. long in an adult

taken June 1 in southern Kwangtung. They are excellent burrowers, and Mell states that they will disappear before one's eyes in soft ground. Captives that he had would climb readily to a height of eight meters, chiefly by the help of the tail. One that he kept would eat boiled sweet potato, mashed and mixed with raw egg, but it later died of threadworms. The Chinese esteem them for their flesh, and for their scales, which are much used in the native "medicines," and will pay up to eight dollars for a specimen. Caldwell has mentioned that pangolins are often eaten by tigers, and the natives will at times invade a tiger's haunts to secure the scales. They also are taken in dead-fall traps set at the entrance to their burrows.

Mr. Clifford H. Pope, in his manuscript notes, states that pangolins are still to be found in the wilder, higher mountains about Futsing, Fukien, but are much less common than formerly, owing to their pursuit by the Chinese. A captive specimen he had readily became fairly tame, and would climb a small tree with agility, for a termites' nest he had suspended there, ripping it open with the powerful claws while the tongue was busily licking up the swarming inmates. He did not find it about Kuatun, although the Chinese hunters knew it, and said it was very rare there.

This seems to be a less common species in Yunnan. Only one individual was secured (at Talifu) by the American Museum Asiatic Expeditions. Anderson (1879), however, probably refers to this species, under *Manis aurita*, and states that it is "very common in all the hilly country to the east of Bhamo and at the still higher elevation of Teng-yue-chow."

Specimens examined:—In all, twenty-one, as follows:

Anhwei: Ningkwofu, 1; Wuhu, 1 (M.C.Z.).
Fukien: Futsing, 12; Yenping, 5.
Yunnan: Talifu, 1.
China, no definite locality, 1.

226. **Manis pentadactyla pusilla** J. A. Allen

HAINAN PANGOLIN

Manis pusilla J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 465, pl. 69, figs. 1-3, 1906.
Manis dalmanni Swinhoe, Proc. Zool. Soc. London, 1870, pp. 236, 652 (in part, as to Hainan).
Manis pentadactyla pusilla G. M. Allen, Amer. Mus. Novitates, no. 429, p. 7, 1930.

Type specimen:—An adult skin and skull from Hainan, without more definite locality, No. 26635, American Museum of Natural History, September, 1902.

Description:—This is a slightly differentiated island race, characterized on the basis of three specimens, only one of which was mature. It is obvious from the description, also, that the specimens were compared with *Phatages crassicaudata*, which will account for the belief that it is "very small," an

excusable mistake without the benefit of Pocock's later review of the group. A comparison of the series secured by Mr. Clifford H. Pope with his mainland series shows that the Hainan animal is quite the same, except for a slight average increase in size, as will appear from the measurements following.

In the skull, the jugal is either lacking altogether, or a minute bony vestige probably representing it is present; at all events, the maxillary process and the squamosal process usually completely bridge the orbito-temporal fossa, their tips touching, or, if they do not quite touch, a small bony element between them, taken to represent the jugal, completes the bridge.

Measurements:—Although none of the specimens taken was measured in the field, the skins, as prepared, probably are very near their original dimensions. The ten largest average: total length, 820 mm.; tail, 325, with extremes between 755 and 920 for total length, and 290-350 for the tail. The average number of scales in the median line is 16.4 on head and body, 17.2 on the tail, with 18.6 at the side of the tail.

CRANIAL MEASUREMENTS OF *MANIS PENTADACTYLA PUSILLA*

No.	Condylo-basal length	Basal length	Palatal length	Zygo-matic width	Breadth of brain case	Length of nasals	Breadth of nasals	Length of lower jaw	Sex	Locality
60004	84.0	81.4	53.0	34.5	37.5	29.0	14.0	59.0	♂	Hainan
60017	94.0	87.0	57.0	36.5	42.5	34.0	14.3	65.0	♂	Hainan
60020	90.0	85.0	55.3	35.0	39.5	30.5	14.2	62.0	♂	Hainan
60006	89.5	84.5	54.5	37.0	37.5	33.0	14.3	62.5	♀	Hainan
60009	89.0	83.0	53.0	35.5	38.0	29.0	13.5	60.0	♀	Hainan
60010	89.0	83.0	52.0	35.0	37.5	30.0	15.4	61.0	♀	Hainan
60021	91.0	84.0	56.0	36.5	40.2	32.5	12.2	63.0	♀	Hainan
60015	87.0	80.2	52.6	33.5	37.0	30.0	11.6	59.0	♀	Hainan
26635 (type)	82.0	76.0	——	——	37.0	30.5	12.0	——	—	Hainan
Average of first 8	89.1	83.5	54.1	35.4	38.7	31.0	13.7	61.4		

Occurrence and Habits:—Mr. Clifford H. Pope found pangolins common about Namfong and Nodoa, Hainan, and readily purchased from hunters as many as he could care for. He believes it must be largely inactive during the winter season, for almost all of those brought in were in late March, April and May, but only one in December and one in January. He writes: "In the patches of jungle all about Nodoa, numbers of perfectly circular clean-cut holes may be found, generally going in at a slant, with fresh earth often piled up in front. These are said to be the work of pangolins. They are wonderful diggers and find no difficulty in making a deep hole right into compact red soil. Their holes are often found leading down into old graves. They are hunted with dogs which frighten the pangolin into curling up when it is easily taken. The Chinese say that it waits for the beating of the heavy spring rains

before coming out of its winter retreat. In walking, the animal doubles the long claws under, and walks on its fist, so to speak. The head is held low with the nose directed down. The tail is held out straight behind parallel to the ground and is not allowed to drag."

Specimens examined:—Twenty in all, viz.:
Hainan: Nodoa, 19; Namfong, 1.

Genus **Phatages** Sundevall

Phatages Sundevall, Kongl. Vet.-Acad. Handlingar for 1842, Stockholm, pp. 258, 273, 1843 (as subgenus, "vel *Phatagenus*"). Pocock, Proc. Zool. Soc. London, 1924, p. 723.

It seems very doubtful if Sundevall, in writing "*Phatages* vel *Phatagenus*" for this pangolin as a subgenus of *Manis*, were really proposing two names as alternatives, as has been supposed, but more likely that he used the former as the native name and the latter as its Latinized equivalent. However, the first name has a Latin appearance, and the second is so like *Phataginus*, used now for the African species *P. tricuspis*, that it is better to follow usage. Pocock has pointed out the chief external characters distinguishing this species, and proposes to regard it as representing a genus distinct from *Manis*, characterized by the greater reduction of the external ear (which is a mere fleshy rim), the lack of the pit-like depression above the anus in the male, the lack of the naked membranous pad found in typical *Manis* at the tip of the tail on the under side, but instead this area is covered by well-developed scales, and the hind foot is covered with more scales. The tail of *Phatages* is proportionally a little smaller and more evenly tapering from the base. The skull differs notably in the shape of the nasal bones, which are of nearly the same width throughout and truncate posteriorly, instead of being wider posteriorly and beveled to a median point. The relations of the antorbital foramen are also slightly different, for, whereas in *Manis* there is a very short canal for the passage of the branch of the fifth nerve, with the bony bridge over it smooth, in *Phatages* the maxillary process has a raised ventral ridge which continues forward across this bony bridge.

The type and only species of the genus is *Manis laticauda* Illiger (=*M. crassicaudata* Geoffroy).

227. **Phatages crassicaudata** (Geoffroy)

INDIAN PANGOLIN

Manis crassicaudata E. Geoffroy, Cat. Mamm. Mus. d'Hist. Nat., Paris, p. 213, 1802.
Manis javanica Anderson, Anat. and Zool. Researches Western Yunnan, p. 352, 1879 (not of Desmarest).
Manis aurita A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 81, 1929 (not of Hodgson).

Type specimen:—The type is presumably mounted in the Muséum d'Histoire Naturelle at Paris.

Description:—Since the genus is now regarded as monotypic, the characters already given apply as well to the species. It may readily be distinguished from the common Pangolin of eastern China by its broader tail with less taper in the terminal part; by the lack of an external ear; the scaly lower tip of the tail, instead of a naked pad, while the skull differs conspicuously in the characters of nasals and bony bridge across the infraorbital canal, as already pointed out. The general color is a similar pale brown.

Measurements:—This species grows to a larger size than *Manis pentadactyla*. Jerdon gives the length of head and body as 26 inches (about 669 mm.), and tail, 18 inches (458 mm.). The weight of a 40-inch female he found to be 21 pounds. These data were from Indian specimens.

The skull of a specimen from near Calcutta measures: greatest length, 101.5 mm.; basal length, 94.8; palatal length, 60.5; width across squamosals, 37; width of brain case, 46.5; length of nasals, 29.5; combined width, 11.

Occurrence and Habits:—This is chiefly an Indian species, from Ceylon and the Indian peninsula eastward to the western border of China, where apparently it very slightly overlaps the range of *Manis pentadactyla dalmanni* in extreme western Yunnan. Anderson (1879), who confused this species with *Manis javanica*, wrote that it "appears to be restricted to the low country about Bhamo and to the outlying spurs of the Kakhyen mountains, not ascending to any great elevation" like the other. One in the U. S. National Museum, recorded by A. B. Howell (1929), is a rather more definite record, having been purchased between Tengyueh and Yunlung, "undoubtedly from either the Salween or Mekong river valley."

Specimens examined:—None.

CHAPTER XI

ORDER RODENTIA

GNAWING MAMMALS

One of the most abundant of the groups living to-day, the rodents are readily distinguished by the arrangement of their teeth, with a large pair of chisel-like incisors above and another pair below, then a long diastema separating the incisors from the row of molariform teeth, with loss of the canines. The geological history of the rodents can be traced back into the early Tertiary, but even at that remote period, the group seems to have been already well marked off, and its various lines blocked out. The order Rodentia is usually divided into two suborders, distinguished by the presence in the first, or Duplicidentata, of a second pair of very small incisors in the upper jaw behind the first pair, while the second suborder, the Simplicidentata, is characterized by having but a single pair in the upper jaw. It was proposed by Gidley that, in view of the many peculiarities of the Duplicidentata and with the lack of known connecting links, they be made a special order, the Lagomorpha, to include the mouse-hares, and the rabbits and their kind. Gregory, in 1910, however, points out that the two suborders have so many points in common, including "a typically complete uterus duplex, a discoidal deciduate placenta, a small allanto-chorion, a large cup-shaped invaginate yolk sack in which the embryo lies, nineteen dorso-lumbars (D 12, L 7), and four endoturbinals with five scrolls," characters "not found in this combination elsewhere," that, in view of these and other correspondences, it seems better to emphasize the essential relationships of the duplicidentate mammals to the other rodents by including them in the same order, rather than to sever them altogether as a separate group.

SUBORDER DUPLICIDENTATA

RABBITS, HARES, AND MOUSE-HARES

The suborder contains but two living families, comprising respectively the mouse-hares or pikas and the hare and rabbit group. An excellent analysis of the skeletal characters of these groups is given by Lyon (1904). The mouse-

hares have become adapted to a somewhat fossorial type of life, some of the Asiatic species living in burrows of their own making, but others, including all the American species, live among broken slide rock, usually at a considerable altitude under alpine conditions. In accordance with this type of life, they have small, rounded ears, short limbs, no tail, and eyes that are partly rotated dorsally to enable the animal to see what is overhead, resulting in the loss of postorbital processes. The hares and rabbits, on the other hand, although some of them make shallow burrows, are essentially surface-livers, and have specialized their structure in accordance, through the lengthening of the hind limbs for leaping, the elongation of the ears, and the lateral position of the eyes, enabling the animal to see in a large part of a half circle on each side. The great shortening of the tail may be attributed to its reduction through an ancestry of semi-fossorial types. The obvious characters of the two families are contrasted as follows:

KEY TO THE FAMILIES OF CHINESE AND MONGOLIAN DUPLICIDENTATA

A. Limbs short, ears not elongated, tail absent; skull with flattened brain case, narrow rostrum, supra-orbital process lacking or reduced to a mere point, jugal much prolonged behind the squamosal root, front face of anterior incisors with a wide superficial groove, their free edge with a V-shaped notch, only two upper molars, the posterior one with a small projection on its hinder inner side..... Ochotonidæ

B. Hind limbs elongated, ears long and narrow, tail short, tuft-like; brain case not flattened, supra-orbital processes well developed, jugal only slightly extended behind the squamosal process, front of upper incisors furrowed, but their edges forming a straight transverse line; upper molars usually three..... Leporidæ

Family OCHOTONIDÆ

MOUSE-HARES

Asia is the home and center of distribution of this group of primitive rabbits, if so they may be called. They are found in a variety of country. Some species are forest dwellers, living among thickets of scrub; others inhabit open flat regions, making burrows and runways in grass patches, while others, again, are rock-living and establish colonies among boulders and broken slide rock, as is the case with all the American species. In Asia they occur in the open Gobi, as well as at alpine heights well above forest levels in the western Chinese highlands and the Himalayas. In earlier geologic times their range covered wider areas, for their remains (referred to the genus *Prolagus*) occur in the Miocene of France and Germany, while in the Pleistocene they were present in Great Britain. Since the Ice Age their western outposts have been considerably withdrawn, so that at the present time they do not extend beyond the Ural Mountains in Europe. All the living species are now included in the single genus *Ochotona*.

Genus **Ochotona** Link

Ochotona Link, Beyträge z. Naturgesch., vol. 1, pt. 2, p. 74, 1795.
Pika Lacépède, Tableau des Mammifères, p. 9, 1799.
Lagomys G. Cuvier, Leçons Anat. Comp., vol. 1, tabl. 1, 1800 (not *Lagomys* Storr, 1780).
Ogotoma Gray, Ann. Mag. Nat. Hist., ser. 3, vol. 20, p. 220, 1867.
Conothoa Lyon, Smithsonian Misc. Coll., vol. 45, p. 438, 1904 (subgenus).

Externally these animals differ from rabbits in their compact form, short limbs with the hind legs hardly longer than the fore, short hind feet, short rounded ears, and in the absence of an external tail. The fore feet have five toes, the hind feet four, all armed with curved slender claws for digging. The fur is fine and soft. Mammæ are either four or six, of which one pair is inguinal, and one or two pectoral. The skull is flattened, and the zygomatic arch is peculiar in the backward extension of its posterior angle, as a long sliver of bone. The teeth show an advance in that the third upper molar, already reduced in the rabbits, is completely gone in the mouse-hares, while the lower premolars are reduced to two on each side. The dental formula is therefore: $i.\frac{2}{1}$ $c.\frac{1}{1}$ $pm.\frac{3}{2}$ $m.\frac{2}{3} = 30$. The groove on the anterior face of the first pair of upper incisors is a simple depression without cement filling, and the inner side of the notch it forms at the cutting edge is shorter than the outer. The first upper premolar has an infolding of the enamel on its anterior face at about the inner third, and a shallow groove at the outer third. The second premolar has a long, nearly transverse fold, extending almost across to the inner side of the tooth. The three other upper teeth have a single fold, extending quite across the tooth, with straight edges, forming thus an excellent triturating surface of alternate hard enamel and softer dentine. In the lower jaw, the first premolar has two short outer, and one inner, enamel folds; the next three teeth (a premolar and two molars) consist of two lozenge-shaped prisms of enamel each, and the last tooth is a single, more or less pear-shaped prism.

The following key will serve to identify the Chinese and Mongolian species. These represent the three subgenera at present recognized, but these groups may prove to be wholly artificial, indicating no very close relationship. In the subgenus *Ogotoma*, the anterior boundary of the palatal vacuity terminates in two notches, one in each premaxilla, that seem to mark the forward extremity of what were originally two distinct openings, one on each side of the median line of the palate. This subgenus is also characterized by the large orbits, with a corresponding narrowness of the interorbital space. The subgenus *Pika* includes those species showing an advance in the condition of the palatal foramina, in that they are not distinctly limited anteriorly, but together form a pear-shaped opening, whose lateral boundaries converge forward, and either meet just behind the incisive foramina, or are practically in contact with the vomer, so that the incisive foramina remain distinct. A

step further is shown by the members of the subgenus *Ochotona*, for in these the incisive and palatal foramina are widely confluent, forming a single opening of triangular shape, with the sides tapering forward to the front of the incisive vacuity.

KEY TO THE CHINESE AND MONGOLIAN SPECIES OF *Ochotona*

A. Incisive and palatal foramina distinct, the premaxillæ either in contact with each other behind the former, or in contact with the vomer.
  a. Palatal foramina ending anteriorly in a distinct notch in each of the premaxillæ; interorbital width distinctly less than the width across nasals at half their length..... Subgenus *Ogotoma*
    a′. Size large, colors pale in winter and summer, terminal pads of the toes evident..... *O. pallasii pallasii*
    O. pallasii pricei
  b. Palatal foramina not ending anteriorly in a notch in each premaxilla, but the outline tapering smoothly to the constriction separating the palatal from incisive openings; interorbital width greater than that of the nasals at half their length ... Subgenus *Pika*
    a′. Skull without a small oval foramen in the anterior end of the frontal; backs of the ears not red.
      a″. Smaller, hind foot less than 30 (about 28) mm..... *O. hyperborea mantchurica*
      b″. Larger, hind foot more than 30 (about 37) mm..... *O. alpina alpina*
      O. alpina argentata
    b′. Skull with a small oval foramen in the anterior end of each frontal; backs of the ears red, or chestnut.
      a″. Smaller, backs of the ears dull chestnut..... *O. gloveri*
      b″. Larger, backs of the ears bright ferruginous..... *O. erythrotis*
B. Incisive and palatal foramina widely confluent, forming a single pear-shaped or triangular opening; premaxillæ not in contact medially with the vomer..... Subgenus *Ochotona*
  a. Smaller species; pelage dark, buffy brown, russet, or dark gray.
    a′. In winter grayish brown, in summer russet above; hind foot 30 mm. or less..... *O. thibetana* and races
    b′. In summer, iron gray without reddish tints, hind foot, 32 *O. roylei chinensis*
  b. Larger species; pelage pale at all seasons, gray to sandy.
    a′. Muzzle and lips of same color as rest of head..... *O. dauurica* and races
    b′. Muzzle and lips black..... *O. dauurica melanostoma*

228. **Ochotona pallasii pallasii** (Gray)

Ogotoma pallasii Gray, Ann. Mag. Nat. Hist., ser. 3, vol. 20, p. 220, 1867.
Lagomys ogotona Waterhouse, Nat. Hist. Mammalia, vol. 2, Rodentia, p. 17, 1848 (not of Cuvier).
Ochotona ogotona Bonhote, Proc. Zool. Soc. London, for 1904, vol. 2, p. 210, 1905.
Ochotona pallasi Thomas, Proc. Zool. Soc. London, 1908, p. 110; *ibid.*, for 1908, p. 982, 1909.

Type specimen:—The type of Gray's genus *Ogotoma*, as well as that of the species *Ogotoma pallasii*, is a skin and skull, No. 45.4.21.5, in the British

Museum, "bought from the dealer Brandt under the name of *Lagomys ogotona*, and said to come from 'Asiatic Russia—Kirgisen' " (Thomas, 1908c, p. 109). The same specimen had previously served for Waterhouse's description of *Lagomys ogotona*, with which he supposed it to be identical, as employed by Cuvier. This, however, was not the case, and Gray's course in naming it as a new species was therefore justified. Bonhote, in his review of the genus *Ochotona* in Asia, misled by the original determination on the label, placed *O. pallasii* in the synonymy of *O. ogotona* (=*O. dauurica*), but Thomas (1909) has cleared away these misunderstandings.

Description:—In winter pelage the entire upper parts of the head and body are pale gray, the hairs minutely tipped with blackish brown and the concealed bases slaty. About the hind quarters the color is slightly brighter with a buffy tint. The forearms and the fore and hind feet are whitish with a faint buffy tinge. The ears are like the back, except that a small area just inside the posterior rim and a similar one on the exterior of the pinna, show as a small brownish-black mark. On the under side, the slaty bases of the hairs show through everywhere, but their short whitish tips combine to give a general whitish surface, marked with a faint buffy wash across the throat, and continued down the median line of the body. About a centimeter below the ear is a curious little patch of appressed upwardly directed rufous hairs. In summer pelage, the color is uniformly brighter, a sandy buff instead of gray, and on the lower surface there is only the faintest suggestion of a buffy wash, instead of a buffy collar and median line. In both summer and winter pelages the soles of the feet are thickly clothed with short whitish hair, but the terminal black pads of the toes are bare and show plainly, forming a ready means of distinction from *O. dauurica*, to which, externally, this species bears a close resemblance in color.

Its skull is highly peculiar, a fact noticed by Gray as long ago as 1867, when he erected for it the genus *Ogotoma*, now used as a subgenus. The striking points are: the complete separation of the incisive and palatal foramina; the decidedly arched profile of the skull, in which the highest point is over the orbit, with a steep anterior slope and hardly less of a slope behind; the comparatively large size of the orbit, so that the lengthwise diameter of the orbito-temporal fossa equals the distance from the base of the anteriormost premolar to the front of the groove on the anterior face of the first upper incisor, whereas in the usual condition in other species this diameter about equals the distance from the anteriormost premolar to the *back* of the first upper incisor.

Measurements:—This is a fairly large species. Ten of the largest measured by the Central Asiatic Expeditions' collectors were as follows:

No.	Total length	Tail	Hind foot	Ear	Sex	Locality
58890	217	9	36	20	♂	Mongolia
58892	210	10	35	23	♂	Mongolia
58895	205	10	35	22	♂	Mongolia
59736	210	15	35	22	♂	Mongolia
59789	205	11	35	20	♂	Mongolia
58891	215	10	34	19	♀	Mongolia
59713	202	17	33	20	♀	Mongolia
58894	206	15	35	22	♀	Mongolia
58903	210	—	33	21	♀	Mongolia
58905	220	19	33	22	♀	Mongolia

CRANIAL MEASUREMENTS OF *OCHOTONA PALLASII PALLASII*

No.	Greatest length	Palatal length	Combined incisive and palatal foramina	Upper diastema	Zygomatic width	Depth through bullæ	Width of palatal bridge	Upper cheek teeth alveoli	Lower cheek teeth alveoli	Locality
58895	44.2	17.5	12.0	9.7	22.3	15.0	2.1	8.4	8.0	Mongolia
58900	47.0	18.0	13.0	10.0	24.0	15.0	2.1	9.0	8.8	Mongolia
58905	47.4	19.0	14.0	10.8	23.2	14.0	1.8	9.5	9.0	Mongolia
58910	47.5	19.0	14.0	10.5	24.0	14.5	1.5	9.2	9.4	Mongolia
58911	43.5	17.5	11.5	8.8	22.0	14.5	2.7	8.9	8.0	Mongolia
59713	47.0	18.2	13.4	10.4	23.7	14.8	1.6	9.0	9.0	Mongolia
59736	50.3	19.1	14.2	11.5	24.6	15.0	1.5	9.4	8.8	Mongolia
59744	47.5	19.0	14.0	11.0	24.0	15.0	1.7	9.0	9.0	Mongolia
59783	47.0	17.5	13.0	10.0	25.0	14.8	2.0	9.5	9.0	Mongolia
59789	48.0	18.0	13.5	10.8	23.7	16.3	1.7	9.4	8.6	Mongolia

Occurrence and Habits:—This coney is abundant in the Gobi, and the Central Asiatic Expeditions succeeded in obtaining an interesting series from various localities, particularly at Gun Burte, Uskuk, and Artsa Bogdo. Dr. R. C. Andrews writes that it is a true rock-living species. Near Tsetsen Wang he "caught the two specimens of adult conies and two young high up the side of a rock peak under the loose stones. The burrows were easily identified by the piles of grass and flower stalks drawn partly into the holes and by the characteristic globular dung." At Gun Burte and Uskuk, he also found it common among the slide rock, and found abundant remains of grass and flower stalks that the animals had dragged into their holes.

A specimen taken May 31, southwest of Tsetsen Wang, is just beginning to show the summer pelage, which appears as small buffy islands on the rostrum, on the left side of the forehead and in one or two places in the middle of the back. In another taken June 21 at Gun Burte, the nose and face have changed, but over most of the body the gray winter fur still remains though worn and ragged. A late July specimen has completely changed.

The unusually large eyes result in a narrowing of the interorbital region

conspicuous in the skull, and probably indicate more or less nocturnal habits. Dr. Andrews writes that the two adults he captured southwest of Tsetsen Wang, as well as one of the young ones, were caught in traps at night, and he concludes that they are largely nocturnal. A second young one, however, was taken in the daytime. These young were taken May 31 and June 1, and others of about the same size were obtained June 21 at Gun Burte, June 25 at Uskuk, and July 11-24 at Artsa Bogdo.

Specimens examined:—In all, some fifty-three, as follows:

Mongolia: Artsa Bogdo, 13; Gun Burte, 22; Kholobolchi Nor, 1; forty miles southwest of Tsetsen Wang, 4; Uskuk, 11; Tuin Gol, 1; Tatsin Gol, 1.

229. **Ochotona pallasii pricei** Thomas

Ochotona (Ogotoma) pricei Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 8, p. 760, 1911.

Type specimen:—An adult female, skin and skull, in the British Museum (original number 208), from the mountains west of Achit Nor, in the Kobdo basin of northwestern Mongolia. Douglas Carruthers, collector.

Description:—The type, in summer pelage, apparently differs in no way from typical *O. pallasii* except in slightly smaller size.

Measurements:—Thomas gives the following measurements of the type and its skull: length of head and body, 178 mm.; hind foot, 29.5; ear, 20.

Skull: occipito-nasal length, 46.8 mm.; condylo-incisive length, 43.6; zygomatic width, 24; length of nasals, 15.8; interorbital width, 4.1; parietal width, 19.6; palatilar length, 17.5; length of palatal foramina, 8.6; upper cheek teeth, alveoli, 9.5.

Occurrence and Habits:—This was described by Thomas as a distinct species, distinguished from *O. pallasii* by its smaller size and slightly less "humped" skull profile, as compared with the type in the British Museum. It does not seem that the characters given, however, are at best of more than subspecific value. Two specimens from northern Mongolia (Tuin Gol and Tatsin Gol) which were supposed to represent this form, are not different from the other Gobi specimens. The type was from Achit Nor in the Kobdo basin, and Thomas mentions a second from Suok, to the westward, at an altitude of 8,000 feet, on the edge of the eastern Altai. When eventually a series of *O. pallasii* from the type locality becomes available for comparison, it may prove that the characters claimed by Thomas are valid for the animal of northwestern Mongolia, but in that case the Gobi animal would probably also stand as *O. p. pricei*. Pending further study, however, the name *O. p. pricei* may be retained in a subspecific sense for the *Ochotona* of this type from extreme northwestern Mongolia.

Thomas's *Ochotona* (*Ogotoma*) *hamica*, from the Hami Mountains, northeastern Turkestan, although not Chinese, comes from very near the edge of Mongolian territory, and is also to be regarded as but subspecifically distinct from typical *O. pallasii*, which Thomas regards as the Altai form.

Specimens examined:—None.

230. **Ochotona hyperborea mantchurica** Thomas

Ochotona (*Pika*) *hyperborea mantchurica* Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 504, 1909.

Type specimen:—The type is a skin and skull, original No. 23, in the British Museum, from Khingan Mountains, northern Manchuria.

Description:—In summer pelage, adults are bright russet above, darkened on the middle of the back by a slight admixture of black hairs; below, the sides and belly are paler, the light tips of the hairs on the latter washed with rusty (ochraceous buff). The pelage throughout is slaty at the base of the hairs, the longer of which at this season are about 12 mm. long. Inside of ear grayish buff, proëctote black; the rim narrowly white. In winter pelage, the russet is doffed for a grayer coat, being a mixture of pale ochraceous and black above, clearer gray on the head and fore back, and brighter on the lower back. Below, dull whitish washed with clay color (Thomas).

In the skull, the incisive foramina are distinct, together forming a single oval opening behind which the thin edges of the premaxillaries are practically in contact, being separated by only a minute space, which is closed by the bone overlying them. The palatal foramen is large and evenly pyriform.

Measurements:—The type measured: head and body, 178 mm.; foot, 28.5; ear, 18. The largest of the series taken by the American Museum Asiatic Expeditions northeast of Urga was: length of head and body, 185 mm.; foot, 25; ear, 19. Another female and a male measured respectively: head and body, 172, 170; foot, 25, 27; ear, 19, 19.

CRANIAL MEASUREMENTS OF *OCHOTONA HYPERBOREA MANTCHURICA*

No.	Greatest length	Palatal length	Length of incisive plus palatal foramina	Upper diastema	Zygomatic width	Mastoid width	Height through bulla	Upper cheek teeth alveoli	Lower cheek teeth alveoli	Locality
45615	38.5	15.0	9.5	7.6	19.0	18.8	12.2	7.2	6.6	Mongolia
45621	40.0	15.8	10.3	8.1	19.5	19.3	13.2	7.0	7.0	Mongolia
45624	39.0	14.7	9.5	7.8	19.0	18.2	13.0	7.4	6.8	Mongolia
45627	38.5	15.0	9.6	8.0	18.3	19.5	12.4	7.5	6.9	Mongolia
45630	41.0	15.5	10.0	8.2	19.2	19.6	13.0	7.3	7.0	Mongolia
45631	39.0	15.8	10.5	8.1	19.4	19.0	13.0	7.3	6.6	Mongolia
45632	39.0	14.3	9.4	8.3	19.0	18.5	12.6	7.5	7.0	Mongolia
45638	41.0	16.0	10.5	8.5	19.6	20.0	13.2	7.5	7.2	Mongolia

Occurrence and Habits:—This small dull-tawny mouse-hare is perhaps the southernmost representative of a group of lesser species retaining the incisive and palatal foramina distinct. The race found in Amurland has been given several names by Schrenck, of which the first, *cinereofusca*, is retained in a subspecific sense. A single specimen from Amurland is extremely like some of the brightest in the Mongolian series, but nevertheless distinctly grayer, and, according to Thomas, this difference is a uniform one, so that he distinguished as *O. h. mantchurica* a series from Khingan, near where the Siberian Railway cuts the range of the same name. This race apparently extends westward to the rocky regions some forty-five miles northeast of Urga, Mongolia, where Dr. Roy C. Andrews secured a fine series in July, 1919. West of this point, however, he did not meet with it, but its place is taken in the Gobi by other species. The typical race extends eastward to eastern Siberia, and is smaller and grayer, while the most northerly is *O. hyperborea kolymensis* of the Kolyma district, Siberia. The richer-colored Amurland race, *O. h. cinereofusca*, is slightly larger than typical *O. hyperborea*, and is exceedingly close to that of Manchuria and northeastern Mongolia.

Well-grown young, 145 mm. in length, were taken the last of July, and by that time most of the adults were changed to the bright russet pelage of summer. This must be carried for a very brief season, for by September 11, one was taken in which the gray fur of winter was coming in on the head, shoulders and fore back.

Specimens examined:—

Mongolia: forty-five miles northeast of Urga, 34; fifteen miles northeast of Urga, 1.

231. **Ochotona alpina alpina** (Pallas)

ALPINE MOUSE-HARE

Lepus alpinus Pallas, Nov. Spec. Quad. e Glir. Ord., p. 52, pl. 2, 1778.
Ochotona alpina Bonhote, Proc. Zool. Soc. London, for 1904, p. 207, 1905.
Ochotona (Pika) alpina Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 408, 1912.

Type specimen:—Pallas's description was based on specimens from the Altai Mountains of Siberia. No definite type specimen was indicated, but possibly some of the original material is still in the Museum at Leningrad, U. S. S. R.

Description:—In summer pelage the entire dorsal surface is a uniform ochraceous orange or light ferruginous, the feet whitish with a strong buffy tint. The ears are thinly clothed with ochraceous hairs within and without, and there is a tuft of longer, paler buffy and white hairs at the anterior base of the ear. Below, the tips of the hairs are everywhere whitish washed with buffy, and there is a well-marked collar across the lower throat of pale ferru-

ginous. The bases of the hairs on the body above and below are slaty as usual.

Specimens in winter pelage are gray with a yellowish tinge.

This species is the type of the subgenus *Pika*, in which the frontal outline of the skull is not abruptly bent or bowed, and the incisive and palatal foramina are separate.

Measurements:—A well-made skin measures approximately 190 mm. in total length; hind foot without claw, 37.

Bonhote (1905) gives the following cranial dimensions: greatest length, 56 mm.; basal length, 46; zygomatic width, 25; length of nasals, 18; upper cheek teeth, 10; interorbital width, 6.

Occurrence and Habits:—Very little is known as to the distribution of this mouse-hare in Mongolia. The only definite record is that of Thomas (1912a, p. 408), who mentions five specimens from the Tannu Ola at from 6,000-8,000 feet, and three males from Kunderlun Mountains, Achit Nor, at 8,000 feet, in extreme northwestern Mongolia. These are said to agree very well with a specimen from the western Altai, Katun River, regarded as practically a topotype. Probably the species will be found to occur in suitable places along the desert ranges to the southeast, intergrading somewhere with the race described by Howell from Kansu as *O. a. argentata*. At the present time, however, nothing seems to be known of it in the intermediate localities.

Specimens examined:—None.

232. **Ochotona alpina argentata** A. B. Howell

SILVERY ALPINE MOUSE-HARE

Ochotona (Pika) alpina argentata A. B. Howell, Proc. Biol. Soc. Washington, vol. 41, p. 116, 1928.

Type specimen:—An adult female, skin and skeleton, No. 240726, U. S. National Museum, from fifteen miles north-northwest of Ningsia, China. Collected May 16, 1923, by Dr. F. R. Wulsin.

Description:—How this race differs from typical *O. alpina* is not stated by its describer, but, compared with the closely allied *O. a. nitida* in winter pelage, the coat is a paler silvery gray "with the yellowish tinge over the back very much reduced. Head paler, and face, as well as the hinder rump, pronouncedly yellowish. Feet white above, grayish below, and longer than in *nitida*. . . . The underparts are white tinged with buffy, and not strongly ochraceous as in *nitida*."

In the skull the orbit is said to be markedly larger than in the latter race, and the posterior palatine foramina longer.

Measurements:—The type specimen and a second from the same locality measured respectively as follows: head and body, 220, 208 mm.; hind foot, 33.5, 33.

The skull of the type measured: total length, 48 mm.; zygomatic width, 24; interorbital width, 5.

Occurrence and Habits:—The record of this species from Ningsia carries the range across from northwestern Mongolia, and is the most eastern extension known. There are no other records for it. While a comparison with typical *O. alpina* would be desirable, it is unlikely that the race *O. a. nitida* is very different from the latter.

Specimens examined:—None.

233. **Ochotona gloveri** Thomas

Ochotona gloveri Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 190, 1922.
Ochotona erythrotis G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 208, 1912 (not of Buechner).
Ochotona (Ochotona) gloveri A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 69, 1929.

Type specimen:—An adult male, skin and skull, No. 13.9.13.17, British Museum, from Nagchuka, western Szechwan, China. Collected August 10, 1908, by Walter R. Zappey.

Description:—A smaller, darker edition of *O. erythrotis*, to which it is probably related. In the summer pelage, the general coloration is a brownish gray above ("dark, lined grayish, with black tips to the hairs"). The ears are dull chestnut on the back, and are sparsely clothed with short ferruginous hairs on the inner side. At the anterior base of the ear is a conspicuous tuft of longer, pale-buffy hairs, and there is a poorly defined pale-buffy area behind the ears. The feet are gray, the separate hairs gray at the base, tipped with white. Cheeks gray, with almost no admixture of russet such as prevails on the muzzle and forehead. Vibrissæ long, some white, others dark-based; longest measure 60 mm. On the ventral side, the color is nearly uniform dull whitish, with the tips of the hairs white or buffy and their bases slaty. The buffy throat is hardly distinct from the color of the rest of the under surface. Soles of the feet densely clothed with short brownish hairs, the tips of the toes with obvious naked pads. The winter pelage is unknown.

The skull has the incisive and palatal foramina separated by a mere constriction only, much as in *O. erythrotis*, but there is a distinct forwardly projecting point on the front side of the palatal bar, not present in the latter. Small vacuities are present at the anterior end of the frontals in one of the specimens but are lacking in two others, while the frontal region itself is comparatively wider than in the larger species.

Measurements:—The collector's measurements of the five specimens of this species were published in the report on Zappey's collection (G. M. Allen, 1912), namely:

No.	Total length	Tail	Hind foot	Locality
7587 MCZ	191	7	35	Szechwan
7588 MCZ	165	6	34	Szechwan
7589 MCZ	204	7	35	Szechwan
7590 MCZ	203	7	35	Szechwan
7591 MCZ	215	6	35	Szechwan

CRANIAL MEASUREMENTS OF *OCHOTONA GLOVERI*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width outside molars	Interorbital width	Upper cheek teeth	Lower cheek teeth	Locality
7587 MCZ	43.5	35.7	16.5	22.2	19.5	13.6	6.2	8.3	7.7	Szechwan
7589 MCZ	46.0	——	——	23.5	——	——	——	——	——	Szechwan
7591 MCZ	48.2	40.5	19.0	24.2	21.7	13.9	5.0	9.0	9.0	Szechwan

Occurrence and Habits:—This seems to be a distinct species, with somewhat the appearance of *O. erythrotis*, but darker, with a brownish instead of bright reddish summer pelage, and of smaller size. The original specimens are from western Szechwan, near the Tibetan border, where at Nagchuka and the Ramala Pass, the late Walter R. Zappey secured the five enumerated above, of which one (7589) was later described as the type of the species by Thomas, and a second was exchanged with the U. S. National Museum. The Nagchuka specimens were from altitudes of from 10,000 to 12,000 feet, but the one from Ramala Pass was taken at an altitude of 15,500 feet. Two others from the same general region, but slightly farther north, were brought back by the Brooke Dolan Expedition in 1931, from Romitchangu and Tapashan, and are in the Academy of Natural Sciences, Philadelphia.

Specimens examined:—Seven, including the type, viz.:

Szechwan (Hsikang): Nagchuka, 4; Ramala Pass, 1; Romitchangu, 1 (A.N.S.P.); Tapashan, 1 (A.N.S.P.).

234. **Ochotona erythrotis** (Buechner)

RED-EARED MOUSE-HARE

Lagomys erythrotis Buechner, Wiss. Resultate d. v. Przewalski Reisen, vol. 1, Säugethiere, p. 165, 1890 (descr.); pls. 21, 24, figs. 1-6, 1894.

Ochotona (Ochotona) erythrotis vulpina A. B. Howell, Proc. Biol. Soc. Washington, vol. 41, p. 117, 1928.

Type specimens:—In the original description, no one of the seven specimens listed is mentioned as the type, so that all seven are cotypes, namely: two from Burchan-Budda, and three from the River Dy-tschju, in eastern Tibet, and two from Kansu, China. They were collected by Przewalski in the course of his expeditions into eastern Asia. In describing the Kansu

animal as *vulpina*, A. B. Howell (1928b) likewise fails to mention any type locality for typical *O. erythrotis*, so that, in order to make matters clearer for future workers, I hereby designate as the lectotype, No. 1554 of the Zoological Museum of the Academy of Sciences, Leningrad, from Burchan-Budda, in eastern Tibet, since most of the description is based on this specimen and its skull is figured.

Description:—In winter pelage the muzzle, forehead, sides of the face, and the entire dorsal surface of the body and limbs (except the feet) are a drabby gray with more or less of a pale-buffy tint. This color is due to the fact that most of the pelage consists of slaty-based hairs of which the exposed portion is whitish, shading into a much shorter pale-buff ring, succeeded by a brownish tip. Scattered here and there are hairs whose exposed portion is all brown, but they are not sufficiently numerous to affect the even brownish-gray tone to the upper parts. The external side of the ears and the margin of the inner surface are bright ferruginous; back from the margin, the rest of the inner side of the ear is nearly bare, with a few whitish hairs, and there is a tuft of long white hairs at the anterior base of the ear. The backs of the feet are pure white to the roots of the hairs, with a faint buffy tint on the toes. The ventral surface of the body is uniformly whitish, with a slightly marked buffy collar from which a buffy wash extends back to the belly in the median area. The soles of the fore feet are pure white, but the dense hairs clothing those of the hind feet are slightly tinged with darker. The naked pads at the tips of the digits are visible.

In summer pelage, "the coloration is a bright and uniform reddish. . . . This color covers the entire dorsal surface of the body, including the head and ears. The belly, chin, legs and feet are white, the hairs being plumbeous at base, but the throat is faintly tinged with reddish" (A. B. Howell, 1928b, p. 117).

Characteristic features of the skull are: the almost complete separation of the incisive from the palatal foramen, the sides of the latter tapering evenly forward, and practically in contact just behind the incisive foramina; the long, parallel-sided nasals; and the two vacuities, one in the anterior dorsal surface of each frontal. The profile of the skull is evenly and slightly arched, and the longest diameter of the orbito-temporal fossa is only very slightly less than the distance from the base of the anterior upper premolar to the groove on the face of the first incisor.

Measurements:—Buechner gives as measurement of total length, 225-285 mm., and for the hind foot, 34-42 mm. Howell's specimens measured 215 in total length, and foot 30 and 34, according to the collector, but "these figures seem to be inaccurate for in the dried skins the foot measures 37.5 in both," as it does also in a specimen from Choni, Kansu, in the Museum

of Comparative Zoölogy. In three specimens from northeastern Tibet, the foot measures 35.5, 38, and 35 respectively.

CRANIAL MEASUREMENTS OF *OCHOTONA ERYTHROTIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Interorbital width	Width of brain case	Width outside molars	Length of palatal foramina	Upper cheek teeth	Lower cheek teeth	Locality
23484 MCZ	48.7	——	19.8	23.5	5.3	18.0	14.8	10.5	9.1	9.0	Tibet
240723 USNM (type of *O.e.vulpina*)	37.3	——	——	13.4	6.2	——	——	6.0	——	——	Kansu
1554 (type)	46.5	——	——	23.7	5.8	——	——	——	8.0	8.0	Tibet

Nomenclature:—With the receipt of additional specimens collected by Joseph F. Rock in northeastern Tibet, and from Choni, Kansu, by Robert B. Ekvall, it does not appear that the Kansu animal is really different, as Howell supposed when, in 1928, he named it subspecies *vulpina*. The coloration is quite the same as in the Tibetan animal, as he himself states, and the specimens since collected show that the size is also the same. The chief supposed difference was the smaller size of the Kansu animal, with shorter palatal foramina, but probably the specimens that served as the type series were not fully grown, though no doubt sexually mature. For the present at least, I would regard them all as constituting a single species.

Occurrence and Habits:—This large mouse-hare has a limited distribution in the northeastern part of Tibet, and thence eastward to the extreme western border of Kansu, China. Its bright rufous ears contrast strongly in winter with the otherwise gray pelage. The original specimens collected by Przewalski were from Burchan-Budda and the River Dy-tschju in eastern Tibet and from an unnamed locality in Kansu. He writes that in the last-mentioned area it is rather common, and confined almost exclusively to the high alpine zone from 10,000 feet upward. It chooses the most desolate rocky places and boulder fields where it runs quickly about on the steep precipices. It is very cautious and when alarmed sits motionless, with its body hunched together, and is difficult to tell from a small stone. It comes out to sun itself on bright winter days.

In China, so far as known, this species is found only in western Kansu, where specimens have been taken at Sining, and at sixty li south of Choni. The example from the latter locality was secured July 20, and has the new

reddish summer coat partly grown. Many of the red hairs are minutely tipped with dark brown, visible with a lens. Dr. Joseph F. Rock, who secured specimens very near the western border of Kansu, in Tibet, found them on rocky bluffs of sandstone and slate, as well as on grassy slopes of the Hwang Ho Gorges at about 10,500 feet elevation.

Specimens examined:—Four, including three from the Hwang Ho Gorges north of Radja, across the Chinese border in Tibet, and a single one from sixty li south of Choni, Kansu.

235. **Ochotona thibetana thibetana** (Milne-Edwards)

MUPING MOUSE-HARE

Lagomys thibetanus Milne-Edwards, in David, Nouv. Arch. Mus. d'Hist. Nat. Paris, vol. 7, Bull., p. 93, footnote, 1871.

Lagomys tibetanus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mammifères, p. 314, pl. 48; pl. 49, figs. 1-1g, 1868-74 (1874).

Ochotona tibetana De Winton and Styan, Proc. Zool. Soc. London, 1899, p. 577.

Ochotona hodgsoni Bonhote, Proc. Zool. Soc. London, for 1904, vol. 2, p. 218, 1905 (in part). G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 207, 1912 (not of Blyth).

Ochotona zappeyi Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 192, 1922.

Ochotona thibetana Thomas, *ibid.*, vol. 11, p. 663, 1923.

Ochotona thibetana sacraria Thomas, *loc. cit.*

Type specimens:—Milne-Edwards never made it a practice to indicate type specimens, but his account of this species is taken from specimens sent to the Muséum d'Histoire Naturelle by Père Armand David, from Muping, Szechwan, China. In his fuller description, two individuals seem to be indicated, one of them in alcohol, which are thus both cotypes.

Description:—In winter the general effect of the pelage above is buffy brown, produced by a very uniform mixture of buffy-tipped hairs with nearly equal proportions of those with tips of a russet brown (about Mars brown of Ridgway); sides of the head of a slightly clearer ochraceous buff, and an indefinite small buffy area behind each ear. Ears dark brown on their exposed portion (proëctote and outer edge of metentote), with a tuft of longer buffy hairs at their anterior base, and their edges very narrowly bordered with white. Backs of the feet whitish, washed with buff. A well-marked buffy collar extends across the throat and continues posteriorly as a buffy wash down the middle line of the belly, while the chin, lower sides of the limbs and the area along each side between the dark of the flanks and the median band of buff, are whitish, with the last-named area sometimes faintly overspread with buff as well. The hairs of both surfaces have slaty bases, concealed when the fur is not disarranged. The soles of the feet are thickly clad with short stiff

hairs, forming a pad of dark brownish; the pad of the terminal joint of each toe, however, is naked and well visible. In summer pelage, which may not be attained till June, the dorsal coloring is much darker, the dark-tipped hairs more profuse, and predominating over the buff-tipped hairs; the general tone of the neck and shoulders is a more russet brown, and the pale collar behind the ears more obvious. The chin remains whitish, but the entire under surface of the body is tinged with ochraceous buff, and the throat collar is nearly russet. The winter pelage is long, about 15 mm. in the middle of the back, while that of summer is much shorter, about 11 mm.

Measurements:—In his more extended description, Milne-Edwards gives for the total length of a specimen, barely 150 mm.; on a succeeding page he adds the dimensions of an alcoholic specimen, namely: total length, 134 mm.; hind foot, 31; ear, length, 19; its width, 15. The length of the hind foot is 29 mm. in the natural-size figure of the animal. Dimensions of the following specimens in the Museum of Comparative Zoölogy, from so near Muping that they may be taken as typical, are as follows:

No.	Total length	Hind foot	Ear	Locality
7592 MCZ	147	26	—	Szechwan
7593 MCZ	167	29	—	Szechwan
7599 MCZ	140	30	—	Szechwan

The cranial measurements in the following table are those of various described "species," or at best geographical races of this mouse-hare, here combined for better comparison. In the skull the basal suture seems to remain open most of the animal's life, so that growth may continue long after the animal is mature. There is much individual variation in the minute details of width of nasals and size of bullæ, that have been used, apparently, with too great reliance in distinguishing some of the races of this species.

CRANIAL MEASUREMENTS OF *OCHOTONA THIBETANA* AND RACES

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Interorbital width	Upper cheek teeth	Lower cheek teeth	Locality
				O. thibetana thibetana						
7592 MCZ	36.6	30.0	13.8	17.4	16.3	10.7	4.5	6.7	6.5	Szechwan
7593 MCZ	37.0	30.5	14.5	17.6	16.3	11.5	4.3	6.8	6.5	Szechwan
7599 MCZ	34.5	28.5	13.6	17.5	15.8	10.5	4.7	6.9	6.5	Szechwan
7594 MCZ	36.9	32.0	14.6	17.7	17.5	11.5	4.4	6.8	6.5	Szechwan
7595 MCZ	——	——	13.1	17.4	——	11.5	4.8	6.5	6.2	Szechwan
7600 MCZ	35.9	29.6	14.0	17.2	15.6	11.0	4.6	6.7	6.1	Szechwan
7129 MCZ	38.5	31.6	14.5	18.6	17.6	11.0	4.5	6.5	6.7	Hupeh

				O. thibetana cansus						
60405	35.4	29.8	14.0	16.2	15.0	10.4	—	6.5	6.0	Kansu
60406	34.6	29.8	12.5	16.0	—	10.2	—	6.0	6.0	Kansu
60407	34.5	29.3	13.0	15.6	16.0	9.8	—	6.2	6.0	Kansu
60408	34.1	29.5	13.1	15.7	15.0	10.2	—	6.0	5.8	Kansu
60410	35.1	30.3	13.5	15.7	15.5	10.2	—	6.2	6.2	Kansu
60411	—	—	13.5	15.4	15.6	10.2	—	6.6	6.1	Kansu
60412	35.5	31.0	14.3	16.0	15.7	10.8	—	6.8	6.0	Kansu
144030 USNM	36.6	30.3	—	16.4	—	—	—	7.0	7.2	Kansu
144029 USNM	34.3	29.5	—	16.1	—	—	—	6.9	6.8	Kansu
				O. thibetana huangensis						
(type)	40.6	—	—	19.9	—	—	4.0	7.8	—	Shensi
56854	40.0	—	15.0	19.3	—	—	—	7.5	7.4	Shensi
56855	37.6	—	14.5	18.5	—	—	—	7.3	7.3	Shensi
56856	38.6	—	14.0	19.3	—	—	—	7.5	7.0	Shensi
56857	—	—	14.6	19.0	—	—	—	7.3	7.0	Shensi
56858	37.6	—	14.0	18.5	—	—	—	7.5	7.0	Shensi
(type of *O. morosa*)	36.5	—	—	—	—	—	—	—	—	Shensi
				O. thibetana sorella						
(type)	36.4	29.0	—	17.0	—	—	4.0	6.7	—	Shansi
				O. thibetana stevensi						
(type)	35.0	—	—	15.9	—	—	3.6	6.6	—	Szechwan
27055 MCZ	36.0	—	14.5	15.7	14.7	10.5	3.4	6.5	6.6	Szechwan
27056 MCZ	35.0	29.5	13.5	16.0	15.5	10.5	3.5	6.3	6.5	Szechwan
27057 MCZ	—	—	14.1	—	—	10.5	3.4	6.5	6.5	Szechwan

Nomenclature:—The type specimen of this species was from Muping, and there may have been a second one sent with it, as the fuller account by Milne-Edwards in the "Recherches" seems to indicate. The original spelling of the specific name, as Thomas pointed out (1922), was *O. thibetana*, though in the later work changed to *O. tibetana*. No other specimens from the Muping district seem to have been collected, but others from nearby localities on the west, south and east may safely be taken as representing it. Thomas regards a specimen from Tatsienlu, to the south, the skull of which was compared with the type, as quite the same (Osgood, 1932). Zappey, who collected for the Museum of Comparative Zoölogy in this region in 1908, secured a small series just west and north of Tatsienlu, at Tachiao and Shuowlow, which after careful comparison seem to be identical, nor do they differ in any important way from others taken on the isolated massif of Wa Shan a few miles from the sacred mountain Omei Shan, to the southeast. There are very slight differences in size of bullæ, width of nasals, or in measurements of other parts, but these are very clearly individual and I can see no course but to regard all the specimens as representing *O. thibetana*. One of the Shuowlow specimens sent to

the British Museum was subsequently described by Thomas as a distinct species, *Ochotona zappeyi;* this was a large adult specimen, so that doubtless the describer was misled into supposing it slightly different, for the others of the series from the same place are obviously sufficiently similar to those to the south and southeast to be regarded as conspecific. I have, therefore, placed *O. zappeyi* in the synonymy of *O. thibetana*, as well as *O. sacraria*, based on a single specimen from Omei Shan. This latter was examined at the British Museum by Dr. Wilfred H. Osgood, who, in commenting on the misleading practice of retaining binomials for the slightly differing races of *O. thibetana*, makes this, "if recognizable," a subspecies. To this doubt may be added the fact that specimens from Wa Shan, the other sacred mountain nearby to the southwest, are undoubtedly the same as *O. thibetana*, and since there are no insuperable physical barriers between, *O. t. sacraria* may be safely relegated to synonymy. Dr. Osgood, in treating other related forms as subspecies, nevertheless continues to maintain *O. cansus* as a separate species, believing that it is distinguishable by smaller size. The study of a large number of specimens representing most of the supposed forms, however, indicates that there is really but one species, *O. thibetana*, of which at best *O. cansus* is a poorly marked race, and *O. morosa* another, hardly more distinct. By making these changes, a rather more logical arrangement of the many names proposed is brought about, and *Ochotona cansus stevensi* of Osgood will apparently represent the southwestern Chinese form, unless in future it may turn out that the latter is indistinguishable from the Sikkim animal, to which Thomas has given the name *O. sikimaria*.

These matters are discussed further under the various subspecies.

Occurrence and Habits:—Originally discovered in the principality of Muping, the typical race of *Ochotona thibetana* apparently occupies the higher parts of the western Chinese highlands and from there as a center, extends northward, probably nearly to the boundary of Szechwan, passing into the slightly paler subspecies *O. t. cansus* in the Min Shan of southern Kansu. To the westward, it extends an uncertain distance toward the Tibetan border, as represented by specimens from Tachiao, Lianghokow, and Shuowlow (type locality of *O. zappeyi*). Eastward of the original locality, there are no records of the typical subspecies, but a specimen in the Museum of Comparative Zoölogy, collected in mid-December at Fanghsien, Hupeh, by W. R. Zappey, appears to be quite the same. It is in completely grown winter pelage and seems to be the most eastern specimen hitherto taken, as well as the sole one for the province. To the south, this form is found on Omei Shan and Wa Shan. Osgood (1932, p. 326) writes that specimens in the British Museum, labeled *O. thibetana*, "are mostly from the Mekong-Yangtze Divide and the Likiang Range, both in Yunnan," but he refers a specimen from the big bend of the

FIG. 21. Distribution Map.
Ochotona

1. *O. thibetana thibetana*
2. *O. thibetana cansus*
3. *O. thibetana huangensis*
4. *O. thibetana sorella*
5. *O. thibetana stevensi*

Yangtze and several from Kulu, Szechwan, to *O. zappeyi*, assuming that it is different in having "a somewhat broader and deeper braincase, a flat, smooth interorbital region and slightly larger audital bullæ." For the present, however, on the basis of specimens examined, I cannot feel certain that this race has any claims to distinction. Thomas (1922b; 1923) regards as typical *O. thibetana* the specimens collected by George Forrest in Yunnan, as follows: Sung-kwei Range, 10,000 ft., 26° 24′ N.; Kiukiang-Salween divide, 11,000 ft.;

Mekong-Yangtze divide, 11,000-13,000 ft.; Mekong valley, 28° N., 11,000-12,000 ft.; and Likiang Range, 13,000-16,000 ft. He believes, however, that they show intergradation toward *O. t. sikimaria* in slightly smaller audital bullæ. He had previously recorded the typical form from twenty-three miles southeast of Tatsienlu, Szechwan, 10,000 ft., and one from the neighborhood of that city, at 11,600 ft. A. B. Howell (1929) has recorded specimens referred to the same species, from Sungpan, in northern Szechwan, as well as from Ulongkong, ten miles south of Tatsienlu.

This species, as might perhaps be suspected from its coloration, is not a rock-dweller like our American forms, but frequents thickets and woods. On Wa Shan, where Zappey secured a small series, as well as on Omei Shan, the lower levels, up to about 6,000 feet, are of the warm-temperate zone, but above this level the vegetation is of a cool-temperate type. According to the botanist E. H. Wilson (1913), the mountain is densely wooded wherever the vegetation can secure foothold, the various species of Rhododendron forming the abundant type of forest with silver fir in the cool-temperate zone, while from 10,000 feet to the top at 11,200 feet, Rhododendron forms ninety per cent of the growth. Zappey collected this species at levels between 8,200 and 11,000 feet on this mountain, indicating that it is not by any means exclusively a high-alpine animal, so that there is no reason to suppose that the specimen taken at an altitude of but 9,500 feet on Omei Shan, hardly forty miles away, represents an isolated form. Père David, who collected the type of *O. thibetana*, also states that he saw this animal in the woods of the high mountains, where it burrows and makes runs among the shrubbery, leaping like a rabbit.

Specimens examined:—Fifteen, as follows:

Hupeh: Fanghsien, 1 (M.C.Z.).

Szechwan: Lianghokow, 1; Tachiao, 2; Shuowlow, 3; Wa Shan, 2 (M.C.Z.); Shagu (Muli), 1 (A.N.S.P.); Tapashan Pass, 2 (A.N.S.P.); Kalong to Merge, 1 (A.N.S.P.); Datsung, 1 (A.N.S.P.); Huanglungkwan, 1 (A.N.S.P.).

236. **Ochotona thibetana cansus** Lyon

Ochotona cansus Lyon, Smithsonian Misc. Coll., vol. 50, pt. 2, p. 136, 1907.
Ochotona roylei Buechner, Wiss. Resultate d. v. Przewalski Reisen, vol. 1, Säugethiere, p. 156, 1890; pl. 23, figs. 1, 2, 1894 (not of Ogilby).
Ochotona cansa Thomas, Proc. Zool. Soc. London, 1911, p. 180.

Type specimen:—An adult male, skin and skull, No. 144030, U. S. National Museum, from Taocheo (Taochow), Kansu, China. Collected June 8, 1906, by W. W. Simpson.

Description:—Like typical *O. thibetana* in all respects but paler, the pale ochraceous of the forehead and muzzle in the winter coat of *O. thibetana*

replaced by a buffy gray, and the pinkish brown of the back and sides by a nearly similar tint, in which buff predominates, with a very even lining of black hairs. The lower surface in both, in winter pelage, has the whitish chin, and ochraceous throat-band, which extends backward as a narrow median stripe along the belly with a nearly white area between this and the flanks. In fully acquired summer coat, this race is paler than *O. thibetana thibetana*, with less black over the dorsal area, which is a more buffy brown. The tuft of longer hairs at the base of the ears is also paler, nearly white. The ventral side differs in the same way, being an even wash of buff over the entire surface except the chin, whereas in the typical race it is a much deeper tint with less white in the tips of the hairs.

The skull does not differ essentially from that of the typical subspecies, except in its slightly narrower zygomatic width and mastoid width as pointed out by Lyon in his description of the form. With a good series of both races for comparison, it is obvious that the cranial differences are really less than at first supposed, the total length being about the same in both, and the width only minutely less. In bodily size there is a certain amount of individual variation, and growth may very likely continue throughout the life of the individual, for the basal suture is not solidly fused in the oldest skulls available. Lyon writes that he fails to see why "the total length of *O. tibetanus* is only 134 mm., while that of *O. cansus* is between 150 and 160." He was misled, however, by Milne-Edwards's measurement of 134 mm. for an alcoholic specimen of the typical race, for on the preceding page of the latter's account, a measurement of 150 mm. is given.

Measurements:—See table, page 539.

Occurrence and Habits:—This race of *O. thibetana* is found along the Min Shan range of southern Kansu, where it appears to reach about the northern boundary of its distribution. The type locality is Taochow, and Thomas (1911d; 1912d) has recorded others from the mountains forty to forty-six miles to the southeast at from 9,500 to 10,000 feet. Others in the collection of the American Museum of Natural History are from the mountains ten miles southwest of Choni and southwest of Archuen. A series from Choni is in the Museum of Comparative Zoölogy. Two specimens from farther to the northwest in the latter institution were collected by Dr. Joseph F. Rock on grassy slopes south of the Hwang Ho, opposite Radja, in western Kansu. Here at an elevation of 11,000 feet the conditions must be much more open and less saturate than farther south, and the specimens are distinctly grayer than typical *cansus*, yet this may be due to fading, since in late May they still retain the winter pelage. The same collector secured a specimen in fine winter pelage in February, 1926, in the Tao River valley near Choni at 8,200 feet

elevation, indicating winter activity. It was taken on a "grassy embankment under spruces." A brood of four small young, some 80 mm. in length, was collected by Mr. Robert B. Ekvall 60 li south of Choni on July 17, 1926. The winter pelage is held in the adult until fairly late, one taken June 28 at Choni having only just begun the change. It is probable that the specimens recorded by Jacobi (1922) and by Howell (1929), from Sungpan, northern Szechwan, belong to this race. At all events the outposts along the edge of the Tibetan plateau, where forest gives way to grass slopes and moisture is less, would tend to cause a paling out in color, as in *O. t. cansus*, and so differentiate them from those of the more saturate wooded country of central Szechwan. Evidently, from the measurements given, Jacobi has confused two species under his *O. hodgsoni*. Buechner has figured and described what is obviously this animal, from Kansu, under the name *Lagomys roylei*.

I have continued to use the masculine form *cansus*, as in Lyon's original account, regarding it as a noun of common gender, as he seems to have intended.

Specimens examined:—In all, twenty-five, as follows:

Kansu: forty miles southeast of Taochow, 1; Tao River valley, near Choni, 1; Choni and vicinity, 16; Archuen and vicinity, 5; south of Hwang Ho, opposite Radja, 2 (M.C.Z.).

237. **Ochotona thibetana huangensis** (Matschie)

TAIPAI SHAN MOUSE-HARE

Conothoa huangensis Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 214, 1908.
Conothoa huanghoensis Matschie, *ibid.*, p. 243 (*lapsus calami*).
Ochotona cansus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 427, 1909.
Ochotona syrinx Thomas, Abstract Proc. Zool. Soc. London, May 2, 1911, p. 27; Proc. Zool. Soc. London, 1911, p. 692.
Ochotona cansa morosa Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 403, 1912.
Ochotona thibetana syrinx Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, p. 328, 1932.
Ochotona thibetana morosa Osgood, *loc. cit.*

Type specimen:—The type is said to be the one of the two original specimens that was given to the Zoological Museum at Berlin, but its number is not stated. It was from an unrecorded spot on the route from Singanfu, in southern Shensi, China, to Lanchow, Kansu. Since, however, the description best fits the race from the former region, the specimen may be assumed to have come from the Tsingling in the vicinity of Sianfu.

Description:—A member of the *thibetana* group, distinguished by its very slightly larger size, and the grayish tone, evenly lined with blackish hairs on the dorsal surface; throat collar very pale buffy, extending as a short buffy median line to the lower chest; rest of under surface whitish, in the winter pelage. The general effect is a distinct gray in the winter pelage, as Thomas has well described. In summer coat, the forehead, cheeks, nape and back

are darker, chestnut lined with black, and the lower surface of the body is broadly washed with dark buffy.

The skull attains a minutely larger size than in the other races, as shown particularly in the breadth of zygomata and across the auditory region. In length the skull may reach 40 mm. but is usually less.

Measurements:—The dimensions externally are about the same as in the typical race, but occasional individuals may by continued growth attain dimensions much in excess of the average. The total length of the type of *syrinx* is said to be 142 mm.; of the type of *morosa*, 149. Two specimens, collected by the American Museum Asiatic Expeditions, measure respectively: total length, 175, 164 mm.; foot with claw, 32, 30.

Cranial measurements are given in the table under *O. thibetana.*

Nomenclature:—The allocation of Matschie's name *Conothoa huangensis* has been the source of some confusion. It was given to one of two specimens in rather poor state of preservation, brought back by the Filchner Expedition of 1903-05. From the fact that Matschie places it in "*Conothoa*," a name for the subgenus having the palatal and incisive foramina united to form a large triangular opening, one infers that it must be a member either of the *O. thibetana* or the *O. dauurica* group. Matschie states definitely that it is like the animal figured by Buechner in his plate 23, fig. 1, as *Lagomys roylei*, but this is really *O. thibetana cansus* in winter coat, and actually does resemble the Tsingling animal as closely as a colored figure could. Thomas has further shown that the bullæ in their long dimension are "markedly smaller" than in *O. dauurica bedfordi* (Thomas, 1909, p. 981). The measurements of the skull, as given by Matschie, agree closely with those of other specimens from the Tsingling and Taipai Shan regions, so that it seems that his name must supersede Thomas's *O. syrinx* and *O. c. morosa*, which were published later, but evidently refer to the same animal. The type of *O. syrinx* was from the Shangchow district of southern Shensi, while that of *O. cansa morosa* came from about one hundred miles farther west on the same range. The former was in winter, the latter in summer coat, which are so different in appearance as undoubtedly to have misled the describer. There seems to be no doubt, however, that both represent the same race, which, in its slightly larger size and grayer coloring, is presumably characteristic of the Tsingling Range and the neighboring Taipai Shan.

Occurrence and Habits:—In addition to the type of this mouse-hare described from Taipai Shan, and the adult female from the same place, Thomas mentions a young one, too youthful for exact determination, taken on the Tsingling Range just north, in the Shangchow district of southeastern Shensi. The single female described from near Fengsiang carries the range a little to

the westward along this mountain system. Dr. J. A. Allen (1909a, p. 427) had previously recorded ten specimens from Taipai Shan, but for lack of comparative material, had referred them to *O. cansus*. Of these, he writes that one taken June 17, and another July 1, had nearly completed the moult to summer or post-breeding pelage. In 1921, the Central Asiatic Expeditions secured several more at an altitude of 10,000 feet on Taipai Shan. One of these, on September 30 had practically completed the moult to winter coat.

Specimens examined:—Fifteen, all from Taipai Shan, Shensi.

238. **Ochotona thibetana sorella** Thomas

SHANSI MOUSE-HARE

Ochotona sorella Thomas, Abstract Proc. Zool. Soc. London, December 15, 1908, p. 45; Proc. Zool. Soc. London, for 1908, p. 982, 1909.
Ochotona (Pika) sorella A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 70, 1929.
Ochotona cansa sorella Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, p. 329, 1932.

Type specimen:—A female, skin and skull, No. 9.1.1.279, British Museum, from twenty miles south of Ningwufu, Shansi, China, altitude 6,600 feet. Collected June 10, 1908.

Description:—In summer pelage, of a general brown color above, "rather darker than Ridgway's 'broccoli-brown,' a lighter patch across the nape. Under surface rather lighter, soiled cream-buff, a more ochraceous-buffy area down the centre of the belly, the slaty bases to the hairs showing through; sides of neck more tawny. Ears blackish grey with white edges. Upper surface of hands and feet cream-buff, their thickly furred palms and soles slaty brownish." Winter pelage pale, resembling that of *O. dauurica*.

"Skull most like that of *O. cansa*, as figured by Lyon, but the upper outline is more convex, the nasals are longer and narrower, the palatal foramina are more widely open, and the bullæ are markedly smaller" (Thomas, 1909, p. 983).

Measurements:—Thomas says that the head and body of the type measured 140 mm., the hind foot, 27, the ear, 18. Although he states that it is even smaller in size than *O. t. cansus*, this does not seem to be borne out by the dimensions of body and skull as given. In a second specimen, however, the foot is said to be but 25 mm. The winter pelage appears to be very pale, more so than in other members of the group.

Occurrence and Habits:—At present but two specimens are known, the type collected at some twenty miles south of Ningwufu, Shansi, and a second from "fifty miles north of Taiyuanfu," or, in other words, at practically the identical place. Anderson, in Thomas's paper, supplies the following note: "The single specimen was taken by Mr. Sowerby in a wood upon an abrupt

hillside, where this, and probably another, had its burrow. The burrows, which were long and intricate, were subsequently dug up without another specimen being found." This specimen, taken June 10, had just given birth to her young and was still nursing. The second specimen (A. B. Howell, 1929, p. 70) was taken in winter (doubtless the one mentioned by Sowerby (1918, p. 52) from Wuchiaku). These records form the most northeastern extension of the species, and are interesting for that reason. The actual differences in size and color, as compared with *O. t. cansus*, are slight, but may be sufficient to characterize the race, which from its outlying position is doubtless a valid one.

Specimens examined:—None.

239. **Ochotona thibetana stevensi** Osgood

STEVENS'S MOUSE-HARE

Ochotona cansa stevensi Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, p. 328, 1932.

Type specimen:—An adult male, skin and skull, No. 33098, Field Museum, from Wushi, southwest of Tatsienlu, Szechwan, China; collected May 14, 1929, by Herbert Stevens.

Description:—In color there is no difference between topotypes and specimens representing the typical race. Of three examined, two taken May 18 are in nearly full but worn winter pelage, while a third taken May 27 is in nearly complete summer coat.

The skull, according to Dr. Osgood, is distinguishable by being narrow and elongate, with small audital bullæ, and it is true that, of two comparable skulls I have examined, both are narrower in zygomatic width and interorbital width than other specimens regarded as typical *O. thibetana*. Among the series of *O. t. cansus* are some of similar appearance and others with an intermediate condition. The bullæ vary in size, as does the skull, in its general proportions with age.

Measurements:—The total length averages 146.3 mm.; hind foot without claws, 26; ear, 18.5 (Osgood, 1932, p. 328); in other words, quite as in the typical race. The skull measurements of three specimens are given with those of other races under *O. t. thibetana*.

Occurrence and Habits:—The recognition of this race seems to me a very doubtful procedure, but out of deference to Dr. Osgood's opinion it may stand for the present until additional study shall confirm it or not. The type locality, Wushi, a short distance south of Tatsienlu, is close to localities whence the typical race of *O. thibetana* has been recorded; others are mentioned by Dr. Osgood from "Chaulu, which is between Wushi and Tatsienlu," and from

Kwanchai, some distance northwest of the same city. Dr. Osgood regards *O. thibetana* as a distinct species from *O. cansa*, so that such an anomalous distribution would be accounted for on the basis of their ranges overlapping. From a study of the material available, I had reached the opposite conclusion, that but a single species is represented with several not very different races. The slight differences in size of bullæ seem to be all that distinguishes the two supposed species, but from analogy of other species of the genus, it seems to me more probable that these are age or individual differences, since all intermediate gradations are found.

Specimens examined:—Three, from Wushi, Szechwan, topotypes (M.C.Z.)

240. **Ochotona forresti** Thomas

FORREST'S MOUSE-HARE

Ochotona forresti Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 11, p. 662, 1923.

Type specimen:—An adult male, skin and skull, No. 23.4.1.91, British Museum, from the northwest flank of the Likiang Range, Yunnan, China, at 13,000 feet altitude. Collected August, 1922, by George Forrest.

Description:—This is described as allied to *O. thibetana* but considerably larger than in any described species of that group. Hair of the back about 15 mm. in length. General color above of the same heavily lined brown as in *O. thibetana*. Under surface dark soiled grayish, the hairs slaty at the base, and whitish or buffy at the tip. Nape dark hoary grayish, this color extending more or less on to the face, but the forehead is brown. Arms buffy or tawny brown. Hands buffy whitish; fore claws very long. Feet dull whitish, metatarsals buffy, brushes of the soles blackish.

The skull is said to be of the same general shape as that of *O. thibetana*, but larger and not so flattened.

Measurements:—The following dimensions are given by Thomas: head and body, 185 mm.; hind foot, 27; ear, 19.

Skull, greatest length, 39 mm.; condylo-incisive length, 37; zygomatic width, 19.4.

Occurrence and Habits:—This, judging from the description, is a large animal, which I had supposed might be a local form of *O. thibetana*, but Osgood (1932) inclines to believe that it is a distinct species. A skin from almost exactly the same locality at 12,000 feet, is evidently one of the *O. thibetana* group, though but 150 mm. long, and if not identical with *O. forresti* must be very similar to it.

Specimens examined:—A skin supposed to be this from the type locality.

241. Ochotona roylei chinensis Thomas

GRAY MOUSE-HARE

Ochotona roylei chinensis Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 8, p. 728, 1911; *ibid.*, ser. 9, vol. 10, p. 406, 1922.

Ochotoma (sic) *roylei chinensis* Thomas, *ibid.*, ser. 8, vol. 9, p. 519, 1912.

Ochotona roylei sinensis Lydekker, Zool. Record, for 1911, Mammalia, p. 46, 1912.

Ochotona huangensis G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 208, 1912 (not of Matschie).

Ochotona (Ochotona) chinensis A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 69, 1929.

Type specimen:—An adult male, skin and skull, No. 11.10.3.7, British Museum, from Yaratsaga, near Tatsienlu, Szechwan, China. Collected May 16, 1911, by Captain F. M. Bailey.

Description:—In winter pelage, the color is described by Thomas as similar to *O. roylei* but clearer gray and paler, lacking any rufous tinge on the head and flanks. The tips of the belly hairs are grayish white, without a buffy suffusion. Ears not especially large, their metentote grayish with a pale-brown edge. Feet grayish white above.

A summer specimen (14 July) seems nearly similar, being of an almost uniform iron gray over the back, due to a mixture of blackish-brown hairs with others that have a subterminal white ring and a blackish-brown tip. The top of the nose and the forehead are very slightly tinged with buff, but otherwise are like the back. There is a pale-buffy area behind each ear, and these almost meet across the nape. The back of the ear (proëctote) is black, and there is a prominent tuft of long buffy hairs at the anterior base; the inner surface is lined sparsely with short buffy hairs, then margined with black, and narrowly edged with white. The feet are gray above with a faint buffy wash. The lower surface is dark gray, the slaty bases of the hairs showing through, and tipped with whitish. The specimen examined shows no trace of a buffy collar or median area.

The skull is characterized by its rather prominent, bowed summit as seen in profile, and by the obvious confluence of the incisive and palatal foramina. There is no constriction of the bony edges between the two, but the sides of the palatal foramina converge forward in a lengthened pyriform outline to the anterior end of the incisive portion. The palatal bridge has a distinct forwardly projecting bony spine on its anterior edge, medially. There is a pair of frontal vacuities, one in the anterior end of each frontal, slightly ahead of the center of the orbit.

Measurements:—The type specimen measured: head and body, 180 mm.; hind foot, 32; ear, 30. A specimen collected in western Szechwan, by W. R. Zappey, measured about the same, namely, head and body, 180 mm.; hind foot, 33.

CRANIAL MEASUREMENTS OF *OCHOTONA ROYLEI CHINENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width outside molars	Upper cheek teeth	Lower cheek teeth	Interorbital width	Locality
(type)	46.5	——	——	23	——	——	8.6	——	5.5	Szechwan
7602 MCZ	40.0	32.5	14.8	21	19.2	11.9	7.4	7.4	5.5	Szechwan

Occurrence and Habits:—This is a very dark, iron-gray mouse-hare, lacking any decided rufous tints on head or body, while the black-backed ears with the contrasting tuft of buffy hair at the anterior base are distinctive. It seems to be widely distributed in the higher parts of western Szechwan Province and Yunnan, although Thomas states that a series from the southwestern part of the latter province seems to show some trace of a rufous mantle, and thus may be nearer typical *O. roylei*. First described from near Tatsienlu in central Szechwan, this species was taken at Yachiakun, 12,500 feet, by W. R. Zappey, slightly to the westward of the same area, in 1908. In 1912, Thomas (1912a) recorded it to the southwest, from Atuntze, northwestern Yunnan, near the Tibetan border, at 16,000 feet, and more recently (Thomas, 1922b) he notes a series of summer skins from still farther south in western Yunnan, namely: six from the Mekong-Yangtze divide, 28° 28′ N., at altitudes of from 12,000-14,000 feet; two from the Mekong valley, 28° N., at 11,000-12,000 feet; and one from the Mekong-Salween divide in the same latitude, at 14,000 feet. Since the type from Tatsienlu is in winter pelage, Thomas regards the identification as provisional. Probably one of these is the same specimen, which he previously (Thomas, 1914a, p. 475) referred to *Ochotona roylei;* it was taken at an altitude of 12,000 feet at Dokerla, by F. Kingdon Ward. Buechner (1892, p. 160) records that several specimens which he identified as *Lagomys roylei* were taken by Potanin on the Nan Shan Range, above tree line in Bardun valley, between Ssolomó and Rdosskuj, but it seems likely that these represent some other species, probably *O. thibetana cansus*. Except for this, the most northern record for *O. r. chinensis* is Sungpan, northern Szechwan, whence the U. S. National Museum has a specimen (A. B. Howell, 1929, p. 69) as well as others from Ulongkong and Nganyangba, in the Tatsienlu region.

Specimens examined:—One, from Yachiakun, western Szechwan.

242. **Ochotona dauurica dauurica** (Pallas)

Lepus dauuricus Pallas, Reise durch versch. Provinzen d. Russ. Reichs, vol. 3, appendix, p. 692, 1776.

Lepus ogotona Pallas, Nov. Spec. Quad. e Glir. Ord., p. 59, pl. 3; pl. 4A, fig. 16, 1778.

Lagomys dauricus Buechner, Wiss. Resultate d. v. Przewalski Reisen, vol. 1, Säugethiere, p. 172, 1890; pl. 22, fig. 1; pl. 25, figs. 1-5, 1894.

Ochotona daurica Bonhote, Proc. Zool. Soc. London, for 1904, vol. 2, p. 216, 1905.

Ochotona dauurica Thomas, Proc. Zool. Soc. London, for 1908, p. 981, 1909.
Ochotona (Ochotona) dauurica dauurica A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 68, 1929.

Type specimen:—None is specified, although some of Pallas's original specimens, said to be still extant in the Museum of the Academy of Sciences at Leningrad, U. S. S. R., may include the animal on which his account is based. He states that "viuit in campis, montiumque decliuibus arenosis, apricis, per totum Dauuriam," so that Dauuria may obviously be regarded as the type locality, that is, north of Urga, Mongolia, on the border of Siberia.

Description:—In winter pelage, the entire dorsal surface from nose to root of tail is a uniform pale sandy buff, except that behind each ear is an ill-defined area of a clear pale buff. Elsewhere the minute brownish-black tips of the hairs succeeding the buffy subterminal portion, darken the general hue very slightly. The backs of the ears are blackish brown, with a prominent whitish tuft at the anterior border, while posteriorly they become pale like the back. The outer portion of their inner side is lined with short pale-buffy hairs, and the rim itself is minutely edged with whitish. The backs of the feet are white, with a wash of pale buff. The under side of the body and limbs is white, with a buffy area across the throat like a collar, continued posteriorly on to the chest in the median line. The soles of the feet are thickly set with stiff short hairs, whitish on the fore feet but more or less drabby on the hind feet.

In summer pelage, the general color is much more yellowish brown, due to the fact that the light subterminal rings of the hairs are pale ochraceous instead of buff, and there seem to be more slender all-black hairs sprinkled among them. Otherwise the type of coloring is the same, with a light buffy patch behind the ears, the proëctote of which is blackish brown, the metectote paler buffy, while the inner side is buffy, bordered with blackish brown and edged with white. The under side is whitish with a buff collar and pale-buff median line nearly the whole length. The claws are long and brownish black. A peculiarity distinguishing this species at once from the rather similarly colored *O. pallasii* is that the pads at the ends of the toes are concealed in the dense hair of the sole and do not show as they do in *O. pallasii.*

In the skull the incisive and palatal foramina are widely confluent and together form a slightly elongate pear-shaped opening, the sides of which are only very slightly concave at the upper part.

Measurements:—The average length of an adult is between 170 and 180 mm., and of about fifty specimens examined, only one exceeded 190. The

following are the ten largest of the series measured by the Central Asiatic Expeditions' collectors:

No.	Total length	Tail	Hind foot	Ear	Sex	Locality
58898	182	13	30	17	♂	Mongolia
59715	172	9	31	22	♂	Mongolia
59728	185	—	30	17	♂	Mongolia
59741	180	11	32	20	♂	Mongolia
59793	192	5	33	19	♂	Mongolia
59717	180	—	29	20	♀	Mongolia
59728	185	—	30	17	♀	Mongolia
59733	182	5	27	19	♀	Mongolia
58884	170	5	33	25	♀	Mongolia
59722	175	5	29	18	♀	Mongolia

CRANIAL MEASUREMENTS OF *OCHOTONA DAUURICA DAUURICA*

No.	Greatest length	Palatal length	Zygomatic width	Length of palatal foramina	Depth through bulla	Upper tooth row	Lower tooth row	Locality
59717	43.6	16.5	21.5	11.2	14.4	8.8	8.5	Mongolia
58884	42.5	16.0	20.6	11.0	13.5	8.3	8.0	Mongolia
59741	43.7	16.0	21.2	11.3	14.0	8.3	8.6	Mongolia
59793	41.3	15.8	20.7	10.0	13.7	8.0	7.4	Mongolia
59747	44.0	17.0	21.0	11.4	14.0	8.2	7.8	Mongolia
59734	43.7	16.5	21.5	11.3	14.5	8.0	8.2	Mongolia
59718	44.0	17.0	20.8	12.0	15.0	8.3	8.0	Mongolia
58888	42.5	16.2	20.2	11.5	14.2	8.6	7.8	Mongolia
59716	40.5	15.0	20.5	10.0	14.4	7.8	8.0	Mongolia
59732	43.0	16.2	20.8	11.2	——	8.3	8.2	Mongolia
58659	39.0	14.5	19.5	10.4	14.5	7.8	7.8 imm.	Shansi

Occurrence and Habits:—This is a characteristic species of the Gobi and differs from the other Mongolian species in selecting as its habitat the patches of long stiff grass that occur here and there, or, as in the eastern part of the Gobi, form the "grass lands." These animals avoid the rocky situations chosen by *O. pallasii*, so that often the two species may be found together in the same general region; but while *O. pallasii* makes its home among the slide rock on the sides of hills or canyons, *O. dauurica* is found burrowing in the patches of grass and weeds in the valley bottoms. The Central Asiatic Expeditions secured a large series of *O. dauurica* from various places in the Gobi, from Kweihwacheng, Shansi, on the southeastern edge of the Mongolian plateau in grass country, to the region of Tsetsen Wang and Artsa Bogdo. The animals make shallow runways through the grass. Dr. R. C. Andrews writes that it is distinctly a grass-living species. "On the desert there are rather extensive patches of long stiff grass as hard as wire. In these spots the conies have their burrows, which usually have fairly well-marked runways near the

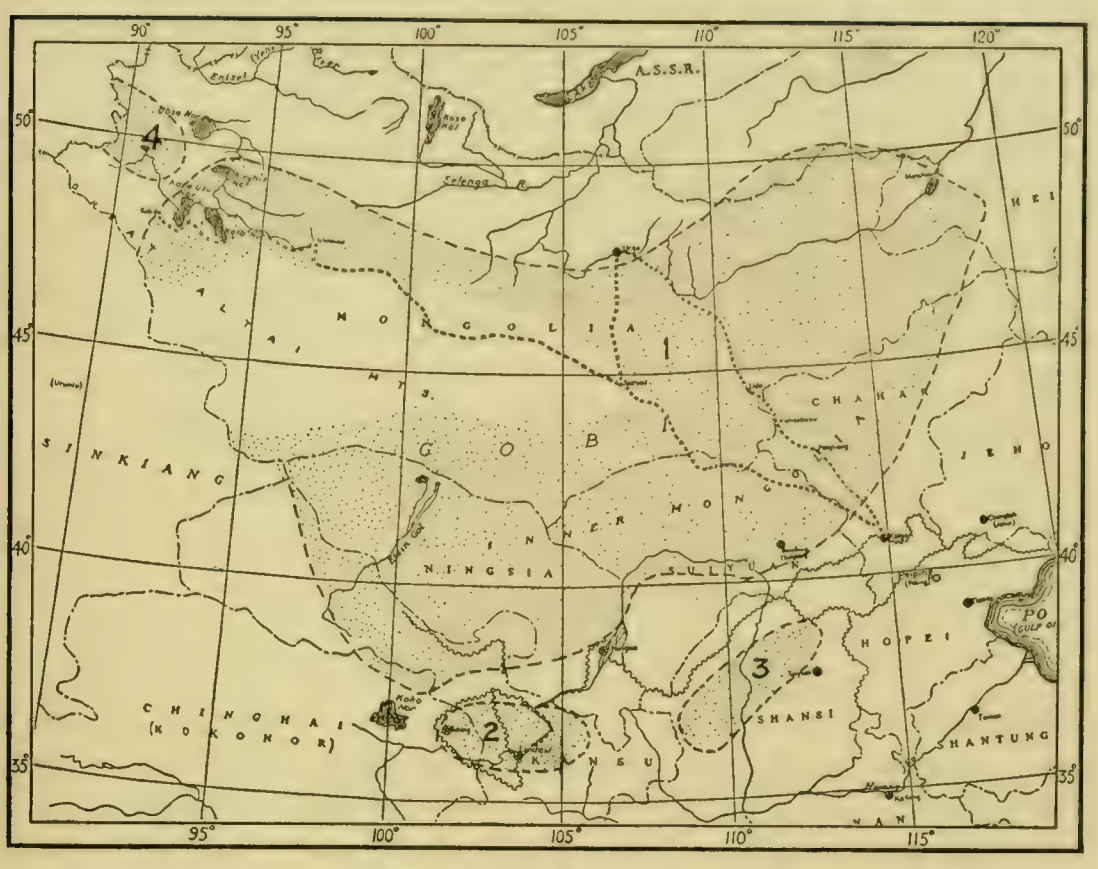

FIG. 22. Distribution Map.
Ochotona

1. *O. dauurica dauurica*
2. *O. dauurica annectens*
3. *O. dauurica bedfordi*
4. *O. dauurica altaina*

hole. There were many flowers and grass tops at the burrow entrance and some grass stems dragged partly in to the burrows. The characteristic spherical dung—about the size of BB shot—is everywhere about the holes. The animals seem to be both diurnal and nocturnal." These "conies" make piles of cut grass, often of considerable size, to cure in the sun, later storing this hay in their burrows for winter use. Przewalski wrote that often grazing herds of antelope will devour these piles, putting the coney to considerable straits for food, and so perhaps becoming an important competitor with it. Such a hay pile is shown in the cut (Plate VII) from a photograph at Artsa Bogdo. The species was taken not only at Tuerin, but at various points to the westward, excepting in the sandy desert, as twenty miles southwest of Urga, Artsa Bogdo, Sainnoin Khan, and Tsetsen Wang, Loh, Uskuk, and Gun Burte, at altitudes up to 8,000 feet.

Four races have been described in addition to the typical form, and the

descriptions are reproduced below, but it appears rather doubtful whether these are sufficiently well characterized to merit recognition. Pending further investigation, however, they may stand for the present.

The winter pelage is carried well into May, but about the twentieth of that month the new coat is seen coming in on head and shoulders, and by mid-June or slightly later is well developed. This species possibly breeds slightly earlier than *O. pallasii*, for very small young (105 mm. long) were taken southwest of Urga on May 18 and 19 and others near Tsetsen Wang on May 21. A young animal taken at Loh had a well-developed first digit on the right hind foot.

Specimens examined:—In all, fifty, from the following localities:

Mongolia: Artsa Bogdo, 7; Gun Burte, 5; Loh, 1; Sainnoin Khan, 13; Tuerin, 2; Tsetsen Wang and vicinity, 6; twenty miles southwest of Urga, 11; Uskuk, 2; on the Ba plain, south of Jugar Range, 10,500 feet, eastern Tibet or western Kansu, 1 (M.C.Z.); north Koko Nor Range, 1 (M.C.Z.).

China: Shansi: Kweihwacheng, 1.

243. **Ochotona dauurica altaina** Thomas

Ochotona dauurica altaina Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 8, p. 761, 1911.

Type specimen:—A male, skin and skull, No. 12.4.1.149, British Museum, from Achit Nor, northwestern Mongolia. Collected August 27, 1910.

Description:—Apparently this race of extreme northwestern Mongolia differs from the central Gobi animal only in having the hind foot on an average slightly longer. Thomas writes: "Apparently quite similar to true *dauurica*, with the exception that the feet are larger. Colour averaging a little paler and greyer. Under surface rather whiter, the hairs with a longer slaty basis. Skull slightly larger."

Measurements:—The type specimen measured as follows: head and body, 182 mm.; hind foot, with claws, 37; without claws, 32.5; ear, 22.5. In six specimens the hind foot measured respectively, 29, 29, 30, 30.5, 31, 32.5. These measurements are practically identical with those of Gobi animals.

The skull of the type measured: occipito-nasal length, 46 mm.; condylo-incisive length, 44.2; zygomatic width, 23; interorbital width, 4.8; parietal width, 18.

Occurrence and Habits:—Thomas regards animals from Suok on the northwestern border of Mongolia as the same as his Achit Nor specimens. This race, if it is to be recognized at all, is possibly a little larger of foot than the typical form, but Thomas's measurements of the hind foot of the latter are less than those of Gobi specimens taken by the Central Asiatic Expeditions; more-

over, the hind foot measurement of *O. d. "altaina"* is not essentially different from that of *O. d. "bedfordi."* It seems very doubtful if the race is worthy of recognition.

Specimens examined:—None.

244. **Ochotona dauurica bedfordi** Thomas

Ochotona bedfordi Thomas, Abstract Proc. Zool. Soc. London, December 15, 1908, p. 45; Proc. Zool. Soc. London, for 1908, p. 981, 1909.
Ochotona (Ochotona) dauurica bedfordi A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 68, 1929.

Type specimen:—An adult female, skin and skull, No. 9.1.1.278, British Museum, from Ningwufu, Shansi, China. Collected June 23, 1908.

Description:—This is said by Thomas to be like the typical race "but with larger bullæ" and "size rather larger," "winter specimens rather paler and greyer." These differences, though exceedingly slight, may suffice to characterize the mouse-hare of this type from the desert region of Shansi south of the Gobi. A specimen examined from Kweihwacheng, Shansi, does not seem distinguishable from typical *O. dauurica*, for the measurements are quite the same. The size of the bullæ, which is regarded as of diagnostic value, varies more or less, and it does not appear that the measurements given by Thomas cannot be matched by those of specimens from near the type locality.

Measurements:—Thomas gives the following dimensions: largest male, head and body, 192 mm.; hind foot, 31; ear, 19. Two females measure respectively: head and body, 185 (type), 175 mm.; hind foot, 31, 32; ear, 22, 21.

The skull of the type measures: greatest length, 44.2 mm.; basilar length, 36.6; zygomatic width, 21; interorbital width, 3.5; breadth of brain case, 17.4; length of palatal foramina, 12.3; oblique diameter of bullæ in plane of basioccipital, 13.5; upper tooth row, 8.5. The oblique diameter of the bulla in specimens from near Urga, and so practically topotypes of *dauurica*, is of much the same size, two of four specimens examined having it 13 mm. as against 13.5 in *bedfordi.*

Occurrence and Habits:—Thomas regards as of this race, specimens from Yenanfu, Shensi, others from the mountains twelve miles northwest of Kolanchow, Shansi, and the type series from Ningwufu, Shansi. While it is possible that these southernmost outpost colonies of *O. dauurica*, living under slightly different conditions, are racially different, this nevertheless seems rather doubtful, from an examination of the few Shansi specimens available. A. B. Howell (1929) states that it is paler in winter pelage than the typical race, but it seems unlikely that the character of the larger bullæ mentioned by Thomas as the basis for its separation, will prove of diagnostic value. Until the matter can be more fully investigated, however, the subspecies may be allowed provision-

ally to stand. Howell has recorded as of this race specimens from Wutsai, and from localities thirty and fifty miles northwest of Taiyuanfu and twelve miles south of Yenanfu, Shensi. He states that Sowerby, who collected the specimens, found their burrows "usually in very dense scrub where the sharp-thorned wild jujube afforded protection from enemies." Specimens from Kweihwacheng, Shansi, I am unable to distinguish from typical *O. dauurica*.

Specimens examined:—None.

245. **Ochotona dauurica annectens** Miller

Ochotona annectens Miller, Proc. Biol. Soc. Washington, vol. 24, p. 54, 1911.
Ochotona (Ochotona) dauurica annectens A. B. Howell, Proc. U. S. Nat. Mus., vol. 75, art. 1, p. 68, 1929.

Type specimen:—The type is an adult male, skin and skull, No. 155164, U. S. National Museum, from Sining (or Chingning-chow), Kansu, China. Collected July 27, 1909, by Arthur de C. Sowerby.

Description:—This race is said to differ from typical *O. dauurica* in having the dorsal outline of the skull less convex and the audital bullæ slightly larger, while from *O. d. bedfordi* it differs in smaller size (particularly of the skull), the more convex upper cranial outline, and much smaller audital bullæ. It seems likely that none of these supposed characters is of great importance.

Measurements:—The type measured: head and body, 181 mm.; hind foot, 29; ear, 20.

The condylobasal length of the skull is 40 mm.

Occurrence and Habits:—According to A. B. Howell (1929), the U. S. National Museum has six specimens, including the type, from fifteen miles northeast of Sining, and one from one hundred and sixteen miles east of Lanchow, Kansu. He mentions that the cranial differences as compared with *O. d. bedfordi* "are too slight to be of great value in diagnosis," though the feet are slightly smaller and the coloration "a faint shade darker." It would not be surprising to find that this supposed race is really to be regarded as indistinguishable from the typical *O. dauurica*. Sowerby, who collected the above series, found them in deep loess gullies and ravines, where they were shy and difficult to secure.

Specimens examined:—None.

246. **Ochotona dauurica melanostoma** (Buechner)

BLACK-NOSED MOUSE-HARE

Lagomys melanostomus Buechner, Wiss. Resultate d. v. Przewalski Reisen, vol. 1, Säugethiere, p. 176, 1890; pl. 22, 1894.
Ochotona melanostoma Bonhote, Proc. Zool. Soc. London, for 1904, vol. 2, p. 215, 1905.

Type specimens:—The original description was based on a series of specimens from Kansu and Tibet, without selection of a definite type specimen.

While it seems best to regard Kansu as the type locality, there are mentioned two lots of three each from there, with a single number covering each lot, so that the selection of a lectotype by number is impracticable without access to the original series.

Description:—Externally the coloration as described by Buechner is very much like that of *O. dauurica*, except that there is a blackish tip to the snout, and the same color extends to the lips, as a sharply marked ring. In addition the lower surface is uniform yellowish or brownish yellow. The color above is sandy brown lined with blackish or brownish black. There is a buffy patch behind each ear, and the flanks are a paler tint than the back.

Measurements:—Buechner's table of measurements shows a range of from 200-242 mm. for total length; hind foot, 33-37; ear, 20-23.5.

Skulls are said to resemble those of *O. dauurica*, but are slightly larger and more massive, with a lower profile in the hinder part. Buechner gives the following dimensions: greatest length, 40-43 mm.; zygomatic width, 21.1-22.7.

Occurrence and Habits:—The specimens brought back by Przewalski on his expedition into eastern Tibet (Koko Nor region) and the western borders of Kansu, seem to be the first known from this region, where the species appears to be common locally, making its burrows in open situations in the desert. Three species of ground-living finches were found to shelter in the burrows and even to nest in them in lack of better protection. Bonhote, who examined a cotype of *O. melanostoma*, regarded it as practically identical with *O. curzoniæ* of Sikkim, differing, if at all, in slightly larger size. It also seems very close to *O. dauurica* in every way except the black nose and lips. Jacobi (1922), in reporting on the mammals from the Weigold Expedition, says, however, that the combined incisive and palatal foramina do not form a straight-sided triangle, but that the sides are slightly bowed inward toward the anterior apex more as in *O. koslovi* than in *O. dauurica*. Until more extensive comparison can be made, its true relationships must remain obscure. Weigold found it a characteristic species of the eastern Tibetan Artemisia plains, where it is abundant and its burrows riddle the ground. These animals sit at the mouths of their burrows and drop into them as the rider approaches. They are silent but watchful, and are chiefly preyed upon by the desert fox and a large buzzard-hawk (*Buteo ferox*). The same collector adds that in August, September, and October they become unbelievably fat, and so are difficult to prepare as specimens at that time.

Specimens examined:—None.

Family LEPORIDÆ

HARES AND RABBITS

At least two genera of hares occur in China, one of which is typical *Lepus*,

represented by the widespread Field Hare, apparently subspecifically related to the European Field Hare, the other a harsh-haired species, which I had earlier referred to the genus *Caprolagus*, but which Ognev (1929a, p. 71) suggests may be a member of his new genus *Allolagus*, based on the Manchurian Hare. Having examined both species, I should prefer to regard the Harsh-furred Hare as better retained in *Caprolagus*. In addition to these, a species of *Oryctolagus*, hardly differing from the European Rabbit, if at all, has been described from Yenchowfu, Chekiang. It would be a remarkable thing to discover a second species of this Mediterranean genus in China, and one cannot help believing that this animal, described as *O. kreyenbergi*, was either an escaped individual of the common European Rabbit, or was a young specimen of Chinese Hare. Its chief distinguishing characters are a double interparietal and the lower incisors with their inner margins parallel instead of approximating.

The two genera of Chinese hares may be distinguished as follows:

KEY TO THE GENERA OF CHINESE AND MONGOLIAN LEPORIDÆ

A. Fur rather harsh, tail with the upper side colored much like the back; ear shorter than hind foot; supraorbital process not marked off from the frontal by an anterior notch..... *Caprolagus*

B. Fur soft, in winter with many longer, stiffer hairs projecting along the sides; tail black above, contrasting with the back; supraorbital process marked off from the frontal by an anterior notch..... *Lepus*

Genus **Caprolagus** Blyth

Caprolagus Blyth, Journ. Asiatic Soc. Bengal, vol. 14, p. 247, 1845.

The type of this genus is the Harsh-furred Hare of the Assam Hills, India, *Lepus hispidus* Pearson. It is characterized by its rather short ears, which are considerably less than the hind foot, the harsh texture of the pelage, the coloration, in which the tail is nearly like the back dorsally; in the skull the postorbital processes are much less developed than in *Lepus*, and are not marked off by a deep notch at the anterior base, but consist instead of a posterior prolongation only. The interparietal outlines are lost in the adult. The teeth are essentially like those of *Lepus*. Apparently the hispid hare of the coastal area of South China should be referred to this genus, and it may eventually prove that the range extends across the extreme south of China, so that the two species are not really geographically isolated from each other.

247. **Caprolagus sinensis sinensis** (Gray)

HARSH-FURRED HARE; CHINESE RABBIT

Lepus sinensis Gray, Illustrations of Indian Zool., vol. 2, pl. 20, 1833-34.
Oryctolagus aff. *kreyenbergi* Mell, Arch. f. Naturgesch., vol. 88, sect. A, no. 10, p. 28, 1922.
Caprolagus sinensis sinensis G. M. Allen, Amer. Mus. Novitates, no. 284, p. 4, 1927.

[*Allolagus*] *sinensis* Ognev, Zool. Anzeiger, vol. 84, p. 71, 1929.
Lepus yuenshanensis Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 9, p. 3, 1930.

Type specimen:—The name is based on the plate inscribed *Lepus sinensis* in the second volume of J. E. Gray's "Illustrations of Indian Zoölogy." This was said to have been drawn from a specimen sent by Reeves from China, but apparently it was not preserved. As noted by Oldfield Thomas, the mammals sent back to London by Reeves came from southeastern China, "more or less in the region of Canton," which may therefore be taken as the type locality.

Description:—Fur rather harsh to the touch; ear not very long, about equaling the length of the skull, and less than the length of the hind foot. General color of the head and back a warm russet, lined with black, the long black hairs predominating in the medial area along the spine. The nape patch clear ochraceous rufous, the fore and hind limbs, a ring around the eyes, and the edging of the ears, the same. Tail above, of the same russet as the back, mixed with a few blackish hairs. Ventrally, only the central area of the breast and abdomen is white, faintly tinged with pale buffy; the chin and flanks and the under side of the tail are light ochraceous buff; the throat is dull buffy brown.

The skull is different from that of *Lepus* in the shape of the postorbital processes, which are not marked off anteriorly by a slit-like notch from the frontal, and taper to a sharp point posteriorly. The postorbital constriction is considerably deeper than in *Lepus*, and the groove on the anterior face of the upper incisors is a simple shallow depression not filled with cement nor continued as lateral outpocketings into the substance of the tooth.

Measurements:—An adult female from Tunglu, Chekiang, measured by the collector, showed the following dimensions: total length, 440 mm.; tail, 35; hind foot, 105; ear, 80.

CRANIAL MEASUREMENTS OF *CAPROLAGUS SINENSIS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Width of brain case	Post-orbital constriction	Upper cheek teeth	Lower cheek teeth	Locality
				Caprolagus sinensis sinensis					
57380	78.0	62.5	30.0	36.3	25.0	12.5	15.3	16.0	Fukien
57381	86.0	69.2	33.6	38.0	27.0	9.0	17.0	17.5	Fukien
45338	84.0	65.5	33.0	37.5	26.5	11.0	15.6	16.0	Chekiang
56523 U. MICH.	84.0	66.2	33.6	40.5	27.0	10.9	15.5	16.4	Kiangsu
56524 U. MICH.	83.1	67.8	33.2	39.9	27.0	11.4	15.6	16.2	Kiangsu
55823 U. MICH.	85.5	67.5	34.5	41.0	28.3	10.4	15.3	16.3	Kiangsu
				Caprolagus sinensis flaviventris					
84500 (type)	77.0	60.5	30.0	37.0	24.5	11.5	14.5	15.5	Fukien
84497	67.0	54.5	27.0	32.5	23.0	11.3	13.5	13.8	Fukien

Occurrence and Habits:—The Harsh-furred Hare is the only native species

of southern China hitherto discovered. It was originally sent from the vicinity of Canton by Reeves, but does not seem to have been reported from the region since, unless Mell's (1922, p. 28) reference to *Oryctolagus* aff. *kreyenbergi* is the same, as seems almost certain from the brief description of the dark cinnamon tail with a few black hairs. He says that it is taken only on a mountain east of "Sin-dsau," where it is apparently not common. In the country about Yenping the American Museum expeditions secured several, but Mr. Clifford H. Pope found it rare about Futsing. Farther north it seems to extend only along the coast at least to the Shanghai region, whence Hollister (1912) records it. There is an adult female also in the American Museum of Natural History from Tunglu, Chekiang, and others from Tekan, Anhwei, and Nanking, Kiangsu, in the University of Michigan. Swinhoe (1870b, p. 449) wrote that about Peiping this smaller and harsher-haired species is commoner than the Field Hare, but this does not seem to have been the experience of later collectors, and it is possible that he was mistaken, since there is no other record of it so far northward, and Sowerby (1914) does not mention it from farther north than the Shanghai region. Nothing seems to be recorded of its habits. Wilson (1913) says that it is common in the reed-bed section of the Yangtze.

In a recent paper, Shih (1930) has described as *Lepus yuenshanensis* what is apparently this same animal, taken at Yuen Shan, Wukanghsien, in southwestern Hunan. The characters claimed for it do not seem to be sufficient to make it separable. Possibly, however, it is the same as the more yellow-bellied race, *C. s. flaviventris*, next treated.

Specimens examined:—In all, eleven, as follows:

Fukien: Yenping, 4.
Chekiang: Tunglu, 1.
Anhwei: Tekan, 1 (Univ. Mich.).
Kiangsu: Nanking, 4 (Univ. Mich.); Shanghai, 1 (Univ. Mich.).

248. **Caprolagus sinensis flaviventris** G. M. Allen

Caprolagus sinensis flaviventris G. M. Allen, Amer. Mus. Novitates, no. 284, p. 5, 1927.
Lepus sinensis Thomas, Proc. Zool. Soc. London, 1898, p. 775.
?*Lepus yuenshanensis* Shih, Bull. Dept. Biol., Sun Yatsen Univ., Canton, no. 9, p. 3, 1930.

Type specimen:—A subadult female, skin and skull, No. 84500, American Museum of Natural History, from Chunganhsien, Fukien, China. Collected August 1, 1926, by Clifford H. Pope.

Description:—Like the typical form but darker, the ochraceous tints deeper and the entire under parts ochraceous buff instead of white in the mid-ventral region. General color above a uniform mixture of ochraceous buff and black. All-black hairs predominate over the back and rump, mixed with the general coat consisting of hairs with a dark base, succeeded by a broad

ochraceous-buff band and a short black tip. Head, anterior outer part of ears, and the tail above, dark mixed black and ochraceous like the back. Sides of the head, especially below the eyes, blackish, only slightly mixed with ochraceous; an ill-defined, pale-buffy eye-ring. Neck patch clear ochraceous rufous. Outer margin of the ears buff, their metentote and metectcte more ochraceous. Fore feet and limbs ochraceous rufous above. Hind feet and entire under parts from chin to lower side of tail, clear ochraceous, the bases of the hairs on the belly gray. A few black hairs are present on the lower throat.

The skull does not seem to differ from that of the typical race.

Measurements:—In the type, the ear measures 62 mm., the hind foot 88, the tail 55. In a larger male, the hind foot is 98 mm., the ear about 60.

Cranial measurements of these two are given in the table under the typical race.

Occurrence and Habits:—In the mountainous region of northwestern Fukien, Mr. Clifford H. Pope found this a common species, about Kuatun. It is known to the natives as the "shan t'u" or Mountain Hare. The five specimens secured include two rather young ones taken June 15 and August 19, respectively. All agree in the more uniformly yellow lower surface of the body than those from Yenping, and I have, therefore, ventured to regard them as a local race, although it may eventually prove that the differences are not as striking as the available material now seems to indicate. As previously noted, it may be that this race extends inland to southwestern Hunan, and that Shih's *Lepus yuenshanensis* from Wukanghsien, Hunan, is a synonym of this, rather than of *C. s. sinensis*. He states (Shih, 1930b) that three fetuses were found in one of the specimens taken between April and June, indicating small litters.

Specimens examined:—In all, five, from Chunganhsien, northwestern Fukien.

249. ?Oryctolagus cuniculus (Linnæus)

Cuniculus kreyenbergi Honigmann, Sitzungsb. Ges. Naturf. Freunde, Berlin, 1913, p. 296.

Without having seen the specimen on which Honigmann based his *Cuniculus kreyenbergi*, it is not possible to be certain as to its identity. He regards it as closely similar to the European Rabbit, and mentions that the skull shows a double interparietal, which precludes it from being a member of either *Lepus* or *Caprolagus*, unless it happens to be an unusual specimen in this respect. The type was said to be fully adult and contained embryos. Should the animal prove to be of the genus *Oryctolagus*, one must suppose that it had been introduced. Apparently the only specimen known is the one described from Yenchowfu, "sehr wahrscheinlich," Fukien.

Genus **Lepus** Linnæus

HARES

Lepus Linnæus, Syst. Nat., ed. 10, vol. 1, p. 57, 1758.

The hares included within this genus are of boreal distribution in both Old and New Worlds; the Arctic species turn white in winter as do also those of sub-boreal distribution, such as the *L. timidus* of northern Europe. In the external form the ears are moderately long; the tail is fairly long and with its

FIG. 23. Distribution Map.
Lepus

1. *L. europæus tolai*
2. *L. europæus swinhoei*
3. *L. europæus filchneri*
4. *L. europæus aurigineus*

terminal hairs about equals the hind foot. The latter is heavily haired, the soles covered with stiffer denser hairs that hide the claws. Miller summarizes the cranial characters as follows: "Skull with bony palate short, its length at narrowest region never more than two and one-half times that of first upper molar; width of choanæ greater than least length of palate . . . ; sutures of interparietal obliterated in adult; postorbital processes broad and triangular, with distinct anterior and posterior limbs; first upper premolar with deep median re-entrant angle, on each side of which is a smaller re-entrant angle of varying depth; anterior portion of anterior lower premolar with a narrow re-entrant angle on its front face and a broad re-entrant angle on external aspect; second to fifth upper cheek-teeth alike, the re-entrant angle extending from inner face about three-quarters of distance across crown, the adjacent edges of the fold closely approximated and finely crenulate . . . ; last upper molar a small elliptic cylinder. . . . "

Of the many species of hares described from China and Mongolia, most are merely local races of the black-tailed or the gray-tailed types, and really represent probably not more than two or perhaps three specific groups. In a recent paper, Ognev (1929a) has reviewed the hares of northern Europe and Asia with a large amount of material and has come to the conclusion that the so-called *L. tolai* group, so well represented in Mongolia and North China, is connected by intermediate subspecies with the typical Field Hares of Europe, a conclusion that is not surprising in view of their general similarity and the fact that many other groups of mammals are continuously distributed across Europe and northern Asia as well. He would include *Lepus timidus*, the Varying Hare, in a genus by itself, and place the Field Hares in *Eulagos* Gray (type, *L. mediterraneus* Wagner). The differences do not seem to be of more than subgeneric importance, however.

KEY TO THE CHINESE AND MONGOLIAN SPECIES OF *Lepus*

A. Upper surface of the tail black, the sides and lower surface white to the roots of the hairs.
  a. Black area of the tail broad, one-half or more of the total width, ears shorter, not exceeding hind foot.
    a′. Foot about 120 mm.
      1. Colors pale, rump gray in winter..... *L. europæus tolai* (Gobi)
      2. Colors less pale, without contrasting gray rump in winter..... *L. europæus swinhoei* (northeastern China, Shantung, Hopei)
      3. Rump not gray, sides and back pinkish buff in tint..... *L. europæus filchneri* (Shansi and Shensi)
      4. Rump not gray, sides and feet bright ochraceous..... *L. europæus aurigineus* (Yangtze basin of eastern China)

b′. Foot about 96 mm..... *L. hainanus* (Hainan)

b. Black area of tail narrow, one-third of the total width; ears longer, exceeding hind foot..... *L. oiostolus* (Kansu)

B. Upper surface of tail blackish or grizzled, its sides and lower surface with the hairs gray-based.

a. Darker, ears and forehead often blackish, combined width of nasals about 20 mm..... *L. oiostolus grahami* (Szechwan highlands)

b. Browner, combined width of nasals about 24 mm... *L. oiostolus comus* (western Yunnan)

250. **Lepus europæus tolai** Pallas

GOBI FIELD HARE

Lepus tolai Pallas, Nov. Spec. Quad. e Glir. Ord., p. 17, 1778.
Lepus gansuicus Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1906, vol. 11, p. 160, 1907.
Lepus gobicus Satunin, *ibid.*, p. 162.
Lepus swinhoei subluteus Thomas, Abstract Proc. Zool. Soc. London, December 15, 1908, p. 45; Proc. Zool. Soc. London, for 1908, p. 979, 1909.
Lepus tolai tolai G. M. Allen, Amer. Mus. Novitates, no. 284, p. 6, 1927.
Lepus europæus tolai Ognev, Zool. Anzeiger, vol. 84, p. 78, 1929.

Type specimen:—Pallas names no individual specimen as the type of this species, but gives the range as "in deserto magno Gobeënsi ubique ad Tybetum usque." Hence the Gobi is the typical habitat, although Satunin has regarded the Selenga River, in Transbaikalia, whence the Academy of Sciences at Leningrad had specimens, as the type locality.

Description:—This is the palest of the eastern races of the Field Hare, and in winter pelage has a markedly gray rump. General color of the top of the head and back a mixture of buffy gray and black, darkest in the middle region of the back and becoming clearer pale buff on the flanks. In the dorsal region the hairs are gray in the basal fourth, shading into buff, and followed by a broad black band, then by a slightly brighter buff band and a minute black tip. Scattered amongst these hairs are others that are all black. The latter are nearly absent on the sides, and the black band and tip on the other hairs are also much reduced. On the rump and across the hips, the coloring becomes grayish white, the hairs slaty gray at their bases. Numerous long, white hairs project beyond the general pelage along the sides from the lower throat to the hips. A pale, grayish white area around the eye extends back to the base of the ear, and forward above the vibrissæ nearly to the muzzle. Outer side of the fore limbs clear ochraceous buff; a narrow pinkish-buff band along the sides delimiting the white of the belly from the mixed buffy gray of the flanks; lower part of the tibia and the backs of the hind feet buffy ochraceous slightly mixed with white. Dorsal surface of the tail deep black. Back of the neck pinkish buff, tipped with white. Ears with the proëctote mixed buffy gray and black like the back, edged with clear ochraceous buff,. their extreme tips black; metectote white; metentote along the middle of the external

border mixed buffy gray and black, white at the base and buffy at the tip, shading into white in the internal area. Below, pure white to the bases of the hairs, except for the dull buffy band across the throat.

In summer pelage, the gray rump is lacking, and there is much less black in the pelage of the back, but the entire dorsal surface of the back is an even buffy, only slightly darkened with black-tipped hairs, the sides slightly clearer. Nape pinkish ochraceous, with very little white tipping. Fore feet and forearm dull ochraceous, hind feet paler, with a whitish inner border. The prominent bristle-like whitish hairs that project along the sides in the winter coat are lacking in summer, and there is less contrast between the back and sides.

The skull resembles that of the European Hare but is much smaller throughout, as is true also of the general bodily size. The Chinese and Mongolian races are all poorly marked and differ little in size, so that the measurements available are grouped together below for more ready comparison.

Measurements:—See table following:

EXTERNAL MEASUREMENTS OF *LEPUS EUROPÆUS TOLAI* AND RELATED RACES

No.	Length head and body	Tail	Hind foot	Ear	Sex	Locality
			L. europæus tolai			
58268	460	103	120	98	♂	Mongolia
57384	430	100	120	90	♂	Mongolia
57385	430	83	117	—	♂	Mongolia
57386	460	80	121	90	♂	Mongolia
57387	480	85	120	85	♂	Mongolia
58267	460	105	120	90	♂	Mongolia
58269	465	95	115	95	♂	Mongolia
60397	475	110	120	95	♀	Mongolia
60400	435	125?	118	91	♀	Mongolia
60403	460	100	120	85	♀	Mongolia
			L. europæus swinhoei			
45285	475	70	115	87	♀	Hopei
			L. europæus filchneri			
45358	450	85	120	92	—	Shansi
45359	490	80	127	98	—	Shansi
45361	420	80	123	95	—	Shansi
45362	490	80	130	90	—	Shansi
	Total length		*L. europæus aurigineus*			
7119 MCZ	510	78	116	—	—	Hupeh
7121 MCZ	532	72	110	—	—	Hupeh
7123 MCZ	533	83	117	—	—	Hupeh
7125 MCZ	530	75	122	—	—	Hupeh
7604 MCZ	535	83	108	—	—	Hupeh
7120 MCZ	590	85	118	—	—	Hupeh
55975	520	90	110	—	—	Szechwan

CRANIAL MEASUREMENTS OF *LEPUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width outside molars	Upper cheek teeth	Lower cheek teeth	Locality
				L. europæus tolai					
45653	84.0	67.0	34.0	42.0	29.0	24.5	16.0	15.5	Mongolia
58268	84.5	67.0	35.0	40.0	29.0	24.0	15.5	16.5	Mongolia
57382	89.0	73.0	38.0	41.0	28.5	23.5	16.5	17.5	Mongolia
57383	86.0	69.0	34.5	41.0	29.0	24.0	16.0	17.0	Mongolia
57384	84.0	67.5	34.5	41.5	30.0	24.0	15.6	16.5	Mongolia
57385	89.0	71.0	35.0	42.5	31.5	25.0	16.0	16.0	Mongolia
57386	86.0	68.5	35.0	39.5	27.0	23.4	16.0	16.4	Mongolia
60393	84.5	68.0	35.0	41.0	28.0	24.0	16.5	17.2	Mongolia
60394	84.0	68.0	34.0	41.0	28.5	23.5	15.4	16.0	Mongolia
60403	84.0	67.5	34.0	41.0	30.0	24.0	15.4	16.0	Mongolia
				L. europæus swinhoei					
45276	83.0	67.0	35.0	40.0	24.7	22.2	15.0	16.0	Hopei
45277	85.0	70.0	35.0	42.0	29.5	24.0	15.0	15.6	Hopei
45280	83.5	68.5	33.5	40.0	29.2	23.8	15.8	16.5	Hopei
45282	87.0	70.0	37.0	39.6	29.0	24.0	15.5	16.5	Hopei
45284	88.5	71.0	35.5	41.2	30.0	24.0	16.6	17.0	Hopei
45285	87.0	72.0	37.0	41.0	28.0	24.2	16.6	17.2	Hopei
45288	85.0	67.0	34.8	39.0	26.0	22.5	15.0	16.5	Hopei
45289	88.0	73.0	37.0	41.0	30.0	25.0	16.0	17.6	Hopei
56932	86.0	69.0	35.5	41.0	28.0	23.6	16.0	17.3	Hopei
				L. europæus filchneri					
45358	87.0	69.5	34.5	39.5	30.0	23.0	15.7	17.2	Shansi
45359	89.0	71.0	36.0	——	30.5	24.0	15.4	16.0	Shansi
45362	85.0	70.0	35.0	39.5	30.7	24.0	15.2	16.0	Shansi
45363	85.0	69.0	34.0	40.5	29.5	22.5	15.8	16.5	Shansi
45364	83.0	67.0	34.0	39.0	27.3	23.0	15.0	16.0	Shansi
45365	87.5	70.0	34.0	41.5	31.3	23.6	16.2	16.7	Shansi
45366	85.0	67.5	35.0	——	28.0	23.0	16.0	16.0	Shansi
45367	86.5	71.0	35.0	41.0	29.0	23.0	16.0	17.5	Shansi
56863	85.5	69.5	35.0	40.0	——	24.0	16.0	16.4	Shensi
56941	86.5	69.5	33.0	39.0	31.0	23.0	16.0	17.8	Shansi

Nomenclature:—Ognev (1929a) has shown that the Field Hares of China and Mongolia are to be regarded as smaller geographic races of the European Hare, which they externally resemble in general type of coloring, with their black-topped tails, and buff and gray mixed pelage. Pallas named the Gobi animal *Lepus tolai*, so that Satunin's *L. gobicus* would seem to be the same, nor does it appear from the description that his *L. gansuicus* from the desert of Kansu Province can be different enough for recognition. The same is also apparently the case with Thomas's *L. swinhoei subluteus*, the type of which is from the southern Gobi, in the Ordos Desert. He compared this with the

Chefoo Hare of Shantung, pointing out its paler coloration and the gray rump-patch, characters which distinguish the Gobi Hare from the Chefoo race, so that there can be no doubt of the identity of *L. s. subluteus* with *L. e. tolai*.

Occurrence and Habits:—Apparently this pallid race is distributed all over the Gobi of Mongolia from the Khingan region in the east, westward, and from the northern to the southern borders of the desert. The Central Asiatic Expeditions brought back a fairly good series, secured on the different journeys all the way from the vicinity of Urga to Tsagan Nor and Artsa Bogdo. Dr. Walter Granger writes, however, that it was usually rare, except that at Uskuk it was abundant in the "bad-land" ravines and gullies. Specimens taken from the middle of May to the latter part of June are in process of moulting the winter fur and acquiring the summer coat.

In the Ordos Desert, Anderson and Sowerby found it "exceedingly abundant" northwest of Chingpien and in the mountains near Kolanchow. Nothing of especial interest seems to have been recorded as to their habits in the desert.

Specimens examined:—Total number, twenty-three, as follows:

Mongolia: Artsa Bogdo, 1; Erhlien (=Iren Dabasu), 2; Tsagan Nor, 2; Ula Usu, 11; vicinity of Urga (thirty miles southeast or southwest), 3; Uskuk, 4.

251. **Lepus europæus swinhoei** Thomas

CHEFOO FIELD HARE

Lepus swinhoei Thomas, Ann. Mag. Nat. Hist., ser. 6, vol. 13, p. 364, 1894.
Lepus stegmanni Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 214, 1908.
Lepus tolai swinhoei G. M. Allen, Amer. Mus. Novitates, no. 284, p. 7, 1927.

Type specimen:—A skin and skull, No. 70.7.18.16, British Museum, from Chefoo, Shantung, China. Collected by Robert Swinhoe in 1870.

Description:—This is a brighter-colored, more buffy race than the typical *L. e. tolai* of the Gobi. In winter pelage the gray rump is much less marked. The general coloring is mixed black and buffy above, with a number of long, white-tipped hairs projecting beyond the rest of the pelage on the sides. The summer coat is shorter and lacks these longer hairs.

The skull does not differ from that of *L. e. tolai*, except that the nasals average slightly longer, 37.8 mm. instead of 35.5, for ten of the latter and nine of *L. e. swinhoei*.

Measurements:—See tables under *L. e. tolai*.

Occurrence and Habits:—This paler race of the Field Hare is common from the vicinity of Peiping, Hopei, southward and eastward into Shantung. How much farther southward this form extends is not wholly certain, but

probably to the Yangtze basin, intergrading with other races, for two skins from Wuhu, Anhwei (Univ. Mich.), seem to be the same.

It is common near Peiping, and is often brought to market. Thomas (1908d, p. 10) records that it is common in the country about Chefoo, Shantung Province, and Weihaiwei, but is rare near Aisan, where there are wolves. According to Weigold, the natives about Peiping hunt them with hawks, but, although now greatly reduced in numbers, they still occur where there is cover. Sowerby (1914) gives an account of hunting hares on horseback in North China, as an exciting form of sport. The hare is a fine runner and usually heads for a graveyard where "it may go to earth in some badger hole, or elude its pursuers by doubling amongst the hummocks." He adds that hares are not nearly as numerous as formerly, and those that remain are both fast and cunning, so that the percentage of kills is very much lower than it was. "South Mongolia simply swarms with them, chiefly round the encampments. Some travellers have put this down to the fact that the camp dogs keep away wolves and foxes. . . . It so happens that these spots afford the only really good cover in the form of tall thickly growing sedgegrass. It is my opinion that the hares seek the shelter of this cover rather than the protection of the camp dogs. . . . A hare uses the same 'form' for a considerable time, and when put up will invariably return to it, making a long circuit. Some will lie very close in these 'forms'." Sowerby mentions two instances in which a hare was discovered in its form, and did not move until touched by the foot. He states (1914, p. 64) that from two to five young are born in a litter, and as they appear very early as well as very late, it may be that more than one litter is produced in a season. In winter, they love warm sunny banks but in summer seek the cool of the densest thorn scrub, while "in cultivated country they may nearly always be found in the family grave patches that are scattered amongst the ploughed fields."

Specimens examined:—Fifteen, namely:

Hopei: Peiping, 10; one hundred miles northeast of Peiping, 1; Tungchow, 2.
Anhwei: Wuhu, 2 (Univ. Mich.).

252. **Lepus europæus filchneri** Matschie

FILCHNER'S FIELD HARE

Lepus filchneri Matschie, Wiss. Ergebn. d. Exped. Filchner nach China u. Tibet 1903-05, vol. 10, pt. 1, p. 217, 1908.
Lepus swinhoei brevinasus J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 427, 1909.
Lepus swinhoei sowerbyæ Hollister, Proc. Biol. Soc. Washington, vol. 25, p. 182, 1912.
Lepus tolai filchneri G. M. Allen, Amer. Mus. Novitates, no. 284, p. 8, 1927.

Type specimen:—The type is a skin and skull in the Berlin Museum, from Hinganfu, southern Shensi, China.

Description:—This hare is a very slightly marked race, distinguishable from the Chefoo Hare by the decidedly pinker, less yellowish tint of the sides and back, and by the buffier tint of the latter and the exposed portion of the ear, including its fringe of longer hairs at the outer edge. There is less tendency to a mixture of buffy hairs with the black of the tail.

Measurements:—See table under *L. e. tolai.*

Nomenclature:—The first name applied to the Field Hare of Shensi is *Lepus filchneri* of Matschie, in 1908, while in the following year the late Dr. J. A. Allen proposed as a provisional name *Lepus swinhoei brevinasus*, in the belief that the nasal bones are shorter than in *L. e. swinhoei.* This does not seem to be the case, however, in the series that I have measured.

Occurrence and Habits:—The area occupied by this race extends from at least southern Shensi to northern Shansi. I can see no difference in specimens from Taipai Shan and Sianfu, southern Shensi, on the one hand, and a series from Kweihwacheng, northern Shansi, on the other, and have, therefore, regarded Hollister's *L. s. sowerbyæ* as a synonym, since it was based on a specimen from northern Shansi west of Ningwufu. It may be added that intergradation with the surrounding races makes difficult the discrimination of many specimens of this hare, for they are but slightly marked.

Specimens examined:—Twenty-two, namely:

Shansi: Kweihwacheng, 11; Maitaichao, 1; Yirgo, 5 (M.C.Z.).

Shensi: forty-five miles south of Fengsiangfu, 1; fifty miles west of Sianfu, 1; one hundred miles southwest of Sianfu, 2; base of Taipai Shan, 1.

253. **Lepus europæus aurigineus** Hollister

HOLLISTER'S FIELD HARE

Lepus aurigineus Hollister, Proc. Biol. Soc. Washington, vol. 25, p. 181, 1912.
Lepus tolai aurigineus G. M. Allen, Amer. Mus. Novitates, no. 284, p. 9, 1927.

Type specimen:—A female, skin and skull, subadult, No. 13761/38173, U. S. National Museum, from Kiukiang, northern Kiangsi, China. Collected December 27, 1880.

Description:—In winter pelage the entire upper parts are bright ochraceous much mixed with black, and clearer ochraceous over the rump instead of gray as in *L. e. tolai.* The spot before the eye, the eye-ring, the inside of the ears and their borders are rich ochraceous, the fore legs and chest-band pale cinnamon, the sides clear buff.

The skull is as in the other races.

Measurements:—See table under *L. e. tolai.*

Occurrence and Habits:—This is the most southern of the races of Field

Hare in China, and is distinguished merely by its slightly richer and brighter coloring from *L. e. swinhoei* and *L. e. filchneri* to the north. The type specimen, which I have examined, was compared by Hollister with *Caprolagus sinensis* in its coloring, but is obviously one of the present group, though the skin is in poor condition, lacking the tail, and the skull is that of an immature animal. A series of winter skins from Hupeh in the Museum of Comparative Zoölogy, collected by the late Walter R. Zappey, is referred to this race, while two other specimens from Wanhsien on the eastern border of Szechwan, taken by the Central Asiatic Expeditions, are similar, though one is less ochraceous than the other. No doubt the brighter tints of this hare are in response to the warmer and moister climate of this southern part of its range in China. E. H. Wilson (1913) writes that around Ichang these hares are fairly plentiful, "though they are getting shot out. They keep close to cultivation, and I never met with one in the sparsely populated mountains of western Hupeh above 5000 feet altitude." As nearly as the data at hand indicate, this race is the one characteristic of the Yangtze basin from eastern Szechwan to at least the middle part of the valley. It possibly just reaches the borders of Yunnan, for the Central Asiatic Expeditions brought back a hunter's skin obtained at Wutinghsien, which seems to represent this race, although the exact locality may not be assignable.

Specimens examined:—In all, twelve, as follows:

Kiangsi: Kiukiang, 1 (U.S.N.M.), the type.

Hupeh: Changyang, 1; Changkow, 2; Fong Shan, 1; Hocha, 1; Ichanghsien, 2; Nantu, 1 (all in M.C.Z.).

Szechwan: Wanhsien, 2.

?Yunnan: Wutinghsien, 1 (hunter's skin).

254. **Lepus centrasiaticus** Satunin

Lepus centrasiaticus Satunin, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, for 1906, vol. 11, p. 158, 1907.

Type specimen:—The description is based on specimen *h* of Przewalski's mammals reported upon by Buechner, a female skin and skull from Satschou (Sachow), western Kansu, China, June, 1879, in the Zoological Museum of the Academy of Sciences at Leningrad.

Description:—This is said to be very like *L. kashgaricus* but distinguished by the gray-based wool hairs. The inside of the ears is clothed with long white hairs. The rump is gray or washed with dark yellow. Outer side of the extremities and fore and hind feet white, sometimes washed with pale buff. Tail with a broad black dorsal stripe.

Measurements:—The hind foot without claw is said to measure 120-123 mm.; ear, 100.

Occurrence and Habits:—This hare, described from the Satschou oasis in extreme western Kansu, is unknown to me. It must be at most a subspecies of *L. europæus*, closely allied to *L. e. tolai*, if indeed it is not practically identical with it. For the present, therefore, it is mentioned in this form without attempting to decide the question.

Specimens examined:—None.

255. **Lepus hainanus** Swinhoe

HAINAN HARE

Lepus hainanus Swinhoe, Proc. Zool. Soc. London, 1870, pp. 233, 639, pl. 18, text-figs. 1-4.

Type specimen:—Swinhoe says that the description was based on a specimen received by him from a mandarin's son. The locality was near the capital city of Hainan. It is now presumably in the British Museum.

Description:—This is a small hare, and is perhaps rather closely related to the Field Hares of North China, from which it outwardly differs chiefly in size, preserving a similar color pattern. In winter pelage, the top and sides of the head, as well as the back, are an even mixture of black and pale ochraceous. On parting the hair, there is seen to be a shorter, denser under fur of a woolly texture, whitish at its base and buffy at the tips; overlying this is the longer outer pelage, consisting of hairs with pale bases, then a broad black band succeeded by a shorter band of ochraceous buff and a short black tip. On the sides of the body, the upper arms and the thighs, the black tips are fewer and the areas clearer, passing into bright ochraceous on the forearms, the backs of the fore and hind feet, and along the inner side of the hind legs. Anteriorly this coloring deepens slightly in the broad band across the lower throat. A well-defined whitish ring encircles the eye and extends indistinctly backward toward the base of the ear and anteriorly toward the muzzle; lower cheeks paler than the area above them. Nape-patch ochraceous buff. Upper part of the tail black, bordered with white. Ears with the proëctote mixed black and buff like the back, metectote whitish at base, black at tip. External edge and the basal half of the inner edge whitish. Metentote back from the white edge buffy brown, shading into buffy white apically. Chin and upper throat, the belly and under side of the tail pure white to the roots of the hairs.

The summer pelage is not greatly different from that of winter, and the latter lacks the prominent white hairs that project along the sides in the *L. europæus* group.

The skull differs from that of the North China Field Hares chiefly in size, for it is much smaller. The groove on the jugal bone is deeper and runs

along the whole length of the bone instead of chiefly the middle section. The groove on the front face of the upper incisors is more or less filled with cement, and to a greater extent than in the Field Hares of North China, and the groove itself is Y-shaped as seen in the section at the tip of the incisors, instead of simply V-shaped.

Measurements:—The foot in dried skins measures 92 and 96 mm. respectively in two adult specimens. The ear in one of these was 78 mm.

CRANIAL MEASUREMENTS OF *LEPUS HAINANUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Interorbital width	Width of brain case	Length of bulla	Upper cheek teeth	Lower cheek teeth	Locality
59896	79	64.0	35.0	38.0	18.0	25.0	9.2	14.6	16.0	Hainan
59897	80	64.0	35.0	39.0	16.5	27.0	9.8	14.5	15.4	Hainan
59898	84	68.0	35.5	40.0	16.0	28.0	9.5	16.0	16.8	Hainan
59899	83	66.5	35.3	39.0	19.0	27.0	9.0	15.0	16.0	Hainan
59900	78	64.5	33.0	37.6	18.2	27.5	9.8	14.3	15.8	Hainan
59901	79	65.0	34.5	38.0	17.6	27.0	9.3	15.5	16.5	Hainan
59902	81	65.0	35.5	39.0	20.5	27.6	9.2	14.5	16.0	Hainan

Occurrence and Habits:—The relationships of the Hainan Hare are not altogether clear, but it is apparently not distantly allied to the small species of similar coloring found in Siam and eastern India, *L. peguensis siamensis* Bonhote. The chief differences, apart from slightly smaller size, that separate the Hainan Hare from the Field Hares of North China, are in the conformation of the grooves on the front face of the incisors and their being filled with cement instead of open; the differences in color are of degree only, and the two are rather similar in summer coat.

This hare was not seen in life by Swinhoe, who first described it, but it is apparently fairly common in suitable localities on the island of Hainan. Mr. Clifford H. Pope, who secured a series for the American Museum of Natural History, writes that its "abundance may be concealed by the amount of dense cover in the form of bush, grass, and jungle. Few hares were brought in to us, and most of those were small. The Chinese trap them with nets and sell them for food as they have a regular market value. I have never seen an adult in the open." No doubt its jungle-living habits are correlated with reduced size. This hare is to be looked for on the mainland opposite Hainan in extreme southern China, but hitherto there is apparently no record of its presence.

Specimens examined:—In all, twenty, most of them immature, of which one is from Namfong, one from Hoihow, and the others from Nodoa.

256. Lepus oiostolus oiostolus Hodgson

GRAY-TAILED HARE

Lepus oiostolus Hodgson, Journ. Asiatic Soc. Bengal, vol. 9, p. 1186, 1840. Buechner, Wiss. Resultate d. v. Przewalski Reisen, vol. 1, Säugethiere, p. 204, pl. 25, 1894.
Lepus sechuenensis De Winton and Styan, Proc. Zool. Soc. London, 1899, p. 576, pl. 32.

Type specimen:—According to Blanford (1898), the type was a very immature animal, and probably the one received from the Hodgson Collection by the British Museum. It came from some unknown locality in southern Tibet. There is still apparently some doubt as to the characters of this species, and Buechner has identified with it a number of hares secured by Przewalski in eastern Tibet and western Kansu. Blanford (1898) suggests that these latter are probably not the same, but until more proof to the contrary is available, the identification of Buechner may be tentatively accepted.

Description:—In winter coat this hare appears externally very similar to *L. europæus tolai* of the Gobi, but is at once distinguished by its much longer ears and longer hind foot, while the black median area of the dorsal surface of the tail is much narrower. In general the coat is fuller. Top and sides of the head, the proëctote of the ears, the median area of the back, a mixture of pinkish buff and black, paling on the sides of the body to pinkish buff with almost no admixture of black hairs, but showing numerous long, projecting white hairs from the fore quarters to the hip. The entire area across the rump and hips is gray, due to the presence of black-tipped hairs among the generally grayish-white hairs of this region. These whitish hairs are pale to the base, except in the median line, where they have extensive gray bases. Tail full-furred, pure white, except for a narrow stripe on the dorsal surface. There is a whitish ring around the eye and an ill-defined mixed gray and blackish area between the eye and the vibrissæ of the muzzle. The nape is clear pinkish buff, with a tipping of white to the shorter hairs beneath the bases of the ears. The latter have a fringe of longer pale-buffy hairs on the middle third of the inner edge; their extreme tip is edged with black. The middle third of the outer exposed edge (metentote) is mixed blackish and buff, but the terminal third is clear buff, and the basal third white. At their tip, exteriorly the ears are black for a short distance, but the basal portion of the backs of the ears is whitish. The throat from just below the chin to and including the forearms, is a uniform pale ochraceous buff. The backs of the feet are whitish, tinted with pinkish buff, but their soles are ochraceous buff.

Summer skins are less buffy, a dark mixture of gray and brown, with the gray rump evident, but lacking the long projecting whitish hairs.

The skull is at once distinguished from that of *L. e. tolai*, found in the same area, by its larger size, with more elongated muzzle and longer tooth rows, but particularly by the broad, triangular supraorbital processes that

stand up at an angle with the general surface of the nasal region as viewed from behind, instead of being on nearly the same level as the middle of the frontals. This gives an outward flare to the supraorbitals, as seen from the side, correlated with the increased size of the orbit, somewhat as in the arctic hares. They nearly or quite touch the parietal suture posteriorly. The audital bullæ are very little larger than in *L. e. tolai*, notwithstanding the larger ears. The groove on the front face of the upper incisors is simple, and deep, V-shaped, and filled with cement.

Measurements:—In a dry skin, the length of the hind foot is 118 mm. (with claw); the ear from the notch of the opening, about 115; from the crown, about 130.

CRANIAL MEASUREMENTS OF *LEPUS OIOSTOLUS OIOSTOLUS*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Combined width of nasals	Upper cheek teeth	Lower cheek teeth	Locality
25348 MCZ	96.0	78.0	43.0	46.0	36.3	25.5	19.6	15.5	17.0	Kansu
240376 USNM	92.4	75.1	38.9	42.6	——	23.0	20.2	15.0	16.5	Szechwan
240379 USNM	94.9	76.7	39.5	42.3	34.8	26.0	21.5	15.6	16.5	Szechwan

Nomenclature:—The characters of this large hare are set forth in some detail by Buechner in his account of the mammals of the Przewalski Expedition, which found it common in eastern Tibet and on the borders of Kansu. A specimen obtained by a later expedition to the latter region by another Russian explorer, Kozlov, and identified as of this species by Dr. B. Vinogradov of the Russian Academy, has served as the basis for comparison. It seems from a study of the available material that the species is identical with the hare described by De Winton and Styan as *Lepus sechuenensis*, from Dunpi, in the northwest corner of Szechwan. Similar specimens in the U. S. National Museum from near Sungpan, at an altitude of about 12,000 feet, were mentioned by A. B. Howell in his account of *L. grahami*, of which they were regarded as non-typical individuals.

Occurrence and Habits:—At first sight this hare in winter coat bears considerable resemblance to the *L. e. tolai* hare but is readily distinguished by its larger size, longer ears, pale feet, narrower black area on the tail, and by the skull with the more erect and flaring supraorbital processes. It is evidently one of the Tibetan steppe fauna, just reaching the high country of extreme western China, and probably extending southward to the Himalayas. Przewalski found it in the Nan Shan about Sachow, in the far west of Kansu, which seems to be its only known occurrence in China. Here, in July, he observed it at altitudes of from 10,000-12,000 feet in the alpine zone as well as in the

valleys at 8,000 feet. It takes shelter among rocks along the river valleys or in deserted marmot holes, and is much shier than the *L. c. tolai*, leaving its form and rushing away while danger is still a considerable way off. Four skins from about Sungpan, 12,000 feet, in northern Szechwan, seem to be undoubtedly the same. These are the skins in the U. S. National Museum considered by Howell as related to *L. grahami*, but "not typical."

It seems very likely that *Lepus kozlovi* Satunin, from Kam, Tibet, is the same as the animal here described, or at least very closely related. If Blanford's surmise that the latter is different from the *L. oiostolus* of southern Tibet be true, then very likely Satunin's name may apply. At present, however, material is not at hand for the determination of this point.

Specimens examined:—The following five:

Kansu: near the lake, Koko Nor, 1.
Szechwan: near Sungpan, alt. 12,000 ft., 4 (U.S.N.M.).

257. Lepus oiostolus comus G. M. Allen

LOWLAND GRAY-TAILED HARE

Lepus comus G. M. Allen, Amer. Mus. Novitates, no. 284, p. 9, September 13, 1927.

Type specimen:—An adult female, skin and skull, No. 43174, American Museum of Natural History, from Tengyueh, Yunnan, China, 5,500 feet altitude. Collected April 19, 1917, by Dr. R. C. Andrews and Edmund Heller.

Description:—In general coloring much like *L. oiostolus*, but the rump less pale, the tail brown above, gray elsewhere, the hind feet slenderer. Head, above, dull ochraceous buff, slightly mixed with black. An indistinct whitish band from the muzzle to the base of the ear, including the eye-ring; cheeks grizzled buffy, gray, and black. Nape patch small, dull russet, with many pale-tipped hairs. The ears dark, mixed buffy and black on the outer anterior side, fringed with longer gray hairs on the basal three-fourths; the posterior edge clearer white; at the extreme tip both the edge of the ear and the terminal part of the outer side are blackish brown. Inside of ears scantily clothed with pale-gray hairs. The back is a dark mixture of buffy and blackish in about equal proportions. The individual hairs are about 32 mm. long, grayish at base, then ringed with ochraceous, then with black, then buffy, with a minute black tip. On the rump the hairs are shorter, the subterminal pale rings whitish. The flanks, fore legs from elbow and outer side of hind legs, clear ochraceous buff, slightly paler on the backs of the hind feet. The tail is of a blackish brown above with a scattering of white hairs; drab gray below, with longer pale hairs having a faintly buffy tip. The throat-band is clear ochraceous, with a few longer white-tipped hairs. Chin, and the inner sides

of the legs to the wrists and heels, the chest and belly pure white, the hairs on the posterior abdomen with gray bases.

The skull chiefly differs from that of *L. oiostolus* in its slender, depressed supraorbital processes, and especially in the broad, flat frontal region, with relatively short nasals. The shape of the interpterygoid fossa is also different, its anterior outline being an even arch, instead of having a median point. In the poorly marked notch separating the anterior wing of the supraorbital, and in the broad basal part of the rostrum, there is some resemblance to the Black-necked Hare of India. The groove on the front face of the incisors is, at some stages of wear, simply V-shaped and filled with cement, but in the type, it is Y-shaped with the lateral arms filled with cement and extending into the body of the tooth in section.

Measurements:—The type measured: length, 480 mm.; tail, 95; hind foot with claws, 130; ear, 97. A second specimen, a nursing female, measures: length, 465 mm.; tail, 110; hind foot, 128; ear, 103.

The skull measurements of the type and a second imperfect specimen are: greatest length, 95, —; basal length, 76, —; palatal length, 39.5, 37; nasals, greatest length, 41, 41; greatest breadth at base, 24, 23.5; zygomatic width, 42.5, —; mastoid width, 30, —; width outside molars, 26, 26.5; upper cheek teeth, 17.6, 17.4; lower cheek teeth, 18.2, 17.5.

Occurrence and Habits:—Several specimens, secured by the American Museum Asiatic Expeditions about Tengyueh on the western borders of Yunnan at altitudes of about 5,500 feet, seem to be the first to be obtained there, although Wroughton (Journ. Bombay Nat. Hist. Soc., vol. 23, p. 477, 1915) mentions that Major Harrington secured some hares "beyond Bhamo" that were not *L. peguensis* and so may have been the present species. Apparently this hare is related to *L. oiostolus*, which it rather closely resembles in color, and in cranial characters; the broad, short rostrum, however, is very different and the postorbital processes are more slender behind, scarcely rising above the general line of the frontals.

This is presumably an inhabitant of lower, warmer country than its highland relative. The series secured by the American Museum Asiatic Expeditions includes a nursing female taken at Tengyueh on April 21, while the type specimen, according to the collector's note, contained two large embryos. A small young one was taken May 10. Osgood (1932) has recorded additional specimens of this hare from Nguluko, Yunnan, and from Zumpa, near Kulu, Szechwan.

Specimens examined:—Four, namely:

Yunnan: Tengyueh, 3, including the type; Likiang, 1, a hunter's skin.

258. **Lepus oiostolus grahami** A. B. Howell

HIGHLAND GRAY-TAILED HARE

Lepus grahami A. B. Howell, Proc. Biol. Soc. Washington, vol. 41, p. 143, 1928.
Lepus sechuenensis G. M. Allen, Mem. Mus. Comp. Zool., vol. 40, p. 207, 1912 (not of De Winton and Styan).
Lepus comus grahami Osgood, Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, p. 326, 1932.

Type specimen:—An adult female, skin and skull, No. 239875, U. S. National Museum, from Ulongkong, about ten miles south of Tatsienlu, Szechwan (now Hsikang), China, altitude about 10,000 feet. Collected July or August, 1923, by David C. Graham.

Description:—"A large, long-eared, boreal hare allied to *L. comus*, but face and especially ears grayer and blacker. The black areas of the hairs of the dorsum are much more extensive and the light areas less ochraceous. The lower rump is markedly dark steel gray and the tail is variable being either pale gray and black, or white and dark gray." The cheeks are grayer and the frontal region blacker. The nape is darker and less ochraceous than in *L. comus*. Tail narrowly dark mid-dorsally, either black or dark gray; below, pale gray or white.

The skull is "more massive than those of the *tolai* group, this being especially noticeable in the width of the rostrum and braincase. The supra-orbital processes are larger and their anterior fissures more extensive. The postero-inferior part of the audital bullæ is also smaller." It is indistinguishable from that of *L. oiostolus oiostolus*.

Measurements:—In the series from which this hare was described, the ear measured from 115 to 125 mm., the hind foot about the same.

CRANIAL MEASUREMENTS OF *LEPUS OIOSTOLUS GRAHAMI*

No.	Greatest length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Combined width of nasals	Upper cheek teeth	Lower cheek teeth	Locality
239874 USNM	93.9	74.5	39.6	44.0	35.5	23.4	20.5	15.5	16.3	Szechwan
239875 USNM	93.1	76.0	39.6	42.7	35.4	25.7	21.6	16.5	17.3	Szechwan
239876 USNM	——	——	39.4	42.1	——	23.0	20.4	15.6	16.0	Szechwan
7603 MCZ	90.5	73.0	40.0	43.0	36.0	22.7	17.2	14.7	15.0	Szechwan

Occurrence and Habits:—While the typical race of *L. oiostolus* inhabits the steppe country of eastern Tibet, and reaches extreme western Kansu and northwestern Szechwan, its place is taken in the highlands of west-central Szechwan by this much darker form, characterized by its heavier coat, as compared with *L. o. comus*, and by the tail which has the under hairs gray instead of pure white to the roots. In the type and other specimens from Ulongkong, ten miles south of Tatsienlu, the ears (proëctote) and forehead

are nearly black, in striking contrast to the usual mixed brownish black and buff. Other specimens from a few miles outside Tatsienlu are normal in this respect, so that the blacker specimens may be slightly melanotic. No doubt *L. o. grahami* will be found to be the upland hare of western Szechwan, reaching, as at Ramala Pass, an altitude of 15,000 feet and more, its darker colors indicating a response to the moister conditions of this mountainous region. Jacobi (1922) has recorded as *Lepus sechuenensis*, what are doubtless specimens of this same hare from Tatsienlu, as well as from Seurong, Sungpan, and near Batang, in western and northwestern Szechwan (Hsikang), but at least the Sungpan specimens are referable to typical *L. oiostolus*. Weigold, who collected these, states that they are common in wooded valleys.

Specimens examined:—In all, five, including the type, namely:

Szechwan (Hsikang): near Tatsienlu, 1 (U.S.N.M.); Ulongkong, ten miles south of Tatsienlu, 3 (U.S.N.M., including the type); Ramala Pass, 1 (M.C.Z.).

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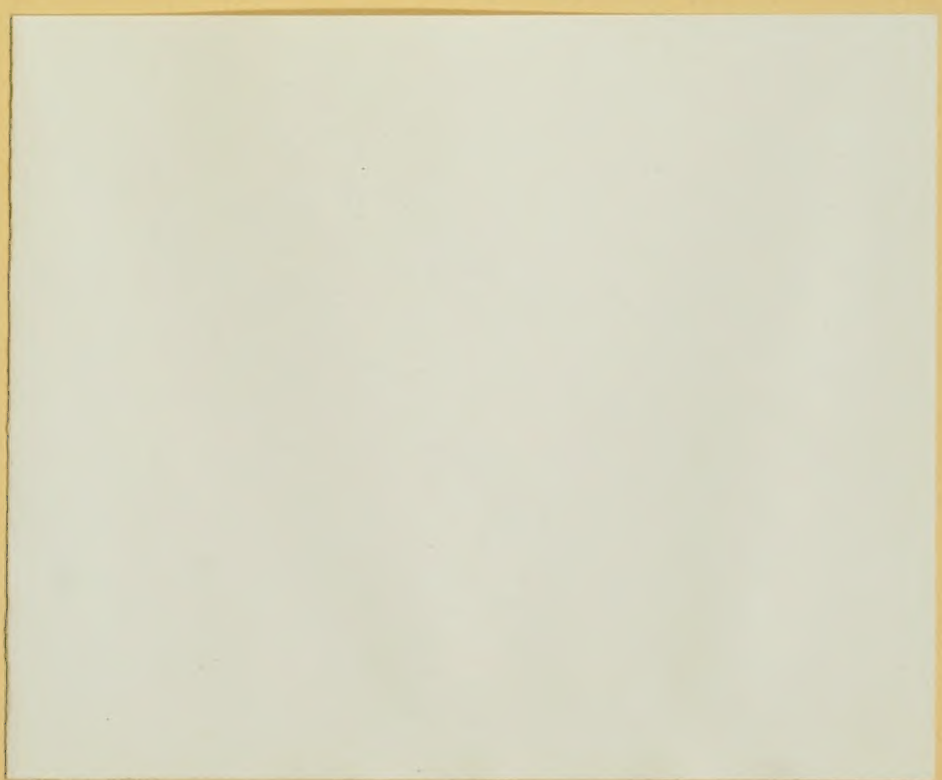

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